1959 Index in June 1960

January 1960

TO BE BOUND

Insulation

Boeschenstein presents Golden Omega to Rickover . . . page 20

In this issue:

E84
644
4 new

ANNOUNCING

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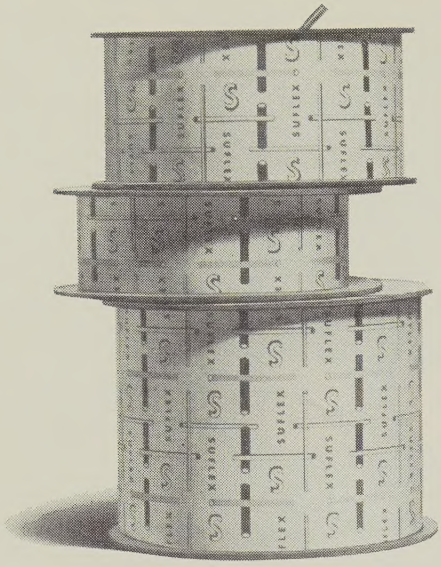

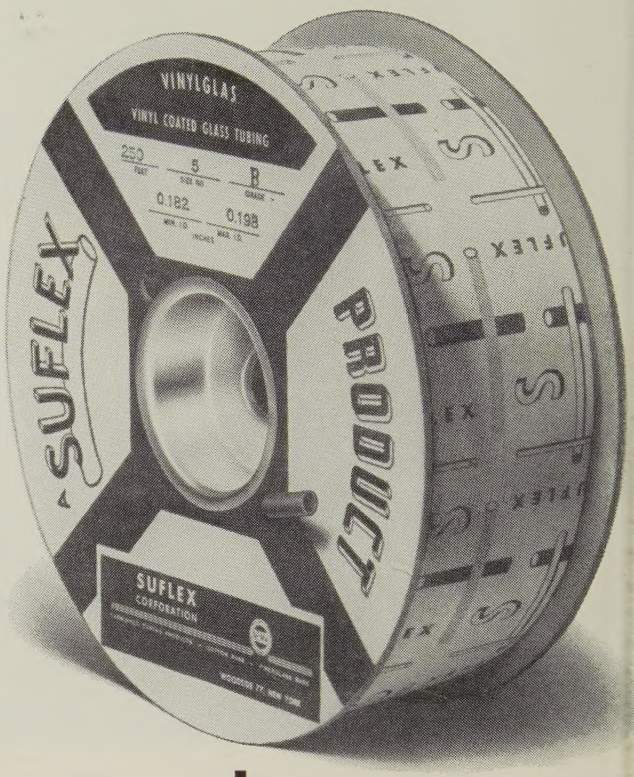

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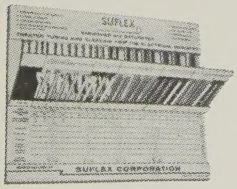

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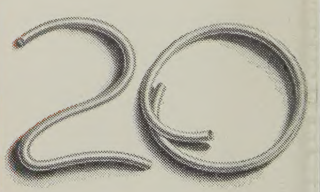

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Insulation

For the Electrical and Electronic Industries

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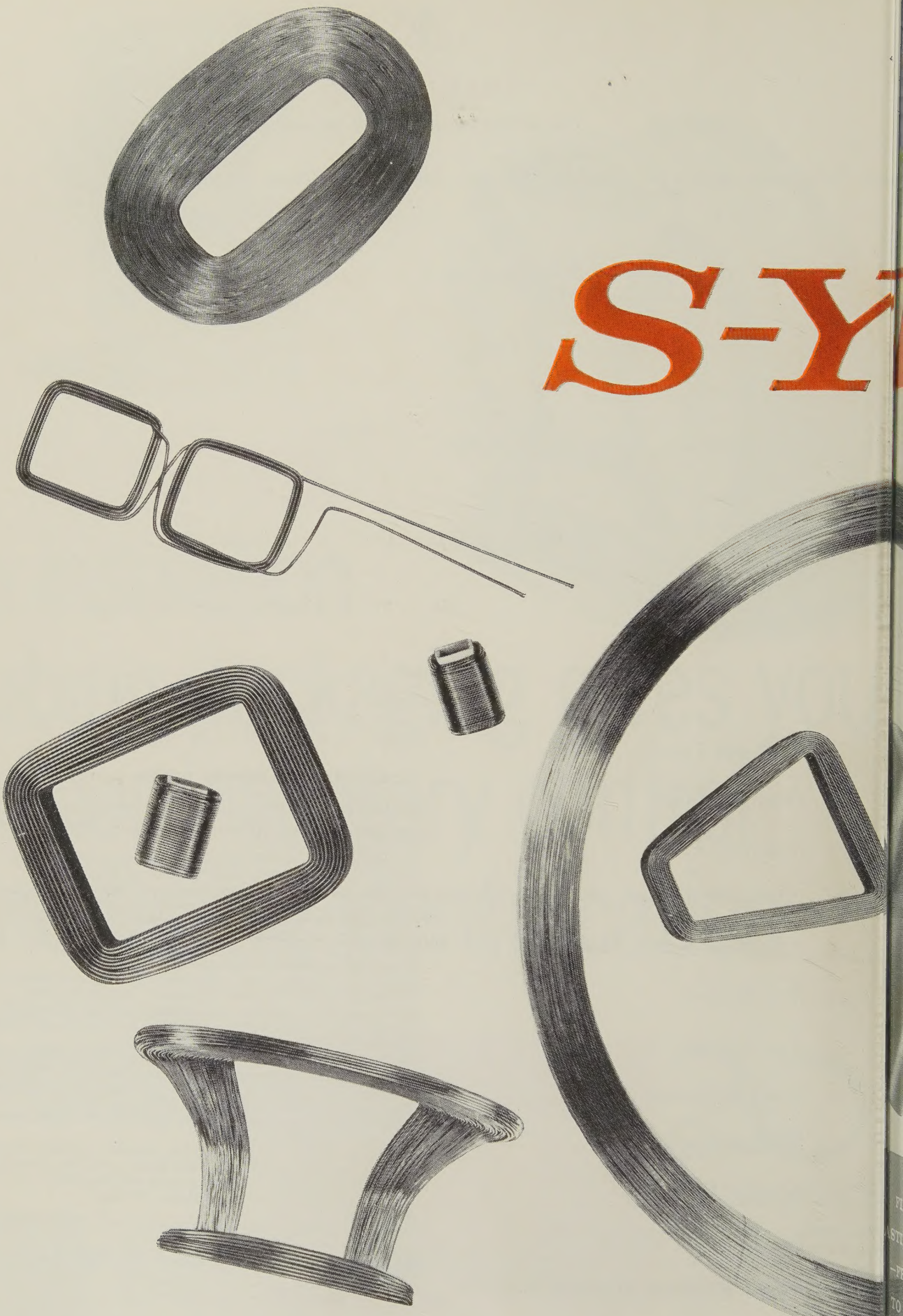
S-Y

THE NEW BONDEZE® WIRE FOR SELF-SUPPORTING COILS...PHELPS DODGE

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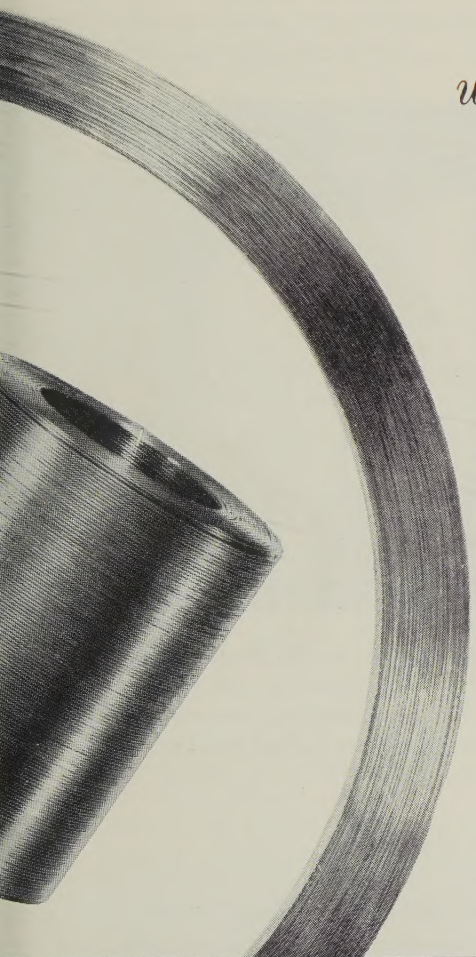

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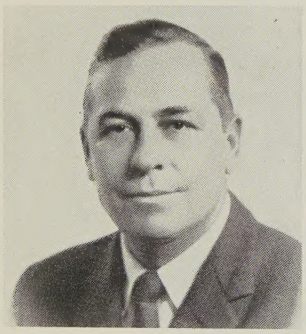
News and Views

Second Hercules Polypropylene Plant

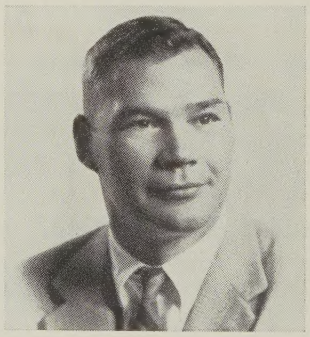
Plans for building a second plant for the production of polypropylene have been disclosed by Hercules Powder Co., Wilmington. The multimillion dollar facility will be designed for an ultimate capacity of more than 100-million pounds per year. The new operation will be located at Lake Charles, La. Completion of the first 50-million pound unit is slated for early 1961. Hercules, responsible for much of the initial interest in polypropylene, obviously is placing a great deal of faith in the material's future . . . and with considerable justification since it appears to be one of the industry's most promising plastics.

Chase Laminating Division Merges with Foster Associates

The Laminating division of Chase & Sons and Foster Associates have been merged—the new electrical insulation company is known as Chase-Foster Inc. Headquarters are located in Providence, R.I. Frank B. Foster, president of the merged company, states that production equipment for the manufacture of laminated and coated insulation products has been installed and is in production. The products will be marketed under the direction of John D. Deacon, vice president and sales manager, through regional representatives and distributors.



Frank B. Foster



John D. Deacon

MIL-I-631 Qualification Test Cost Allocation Changed

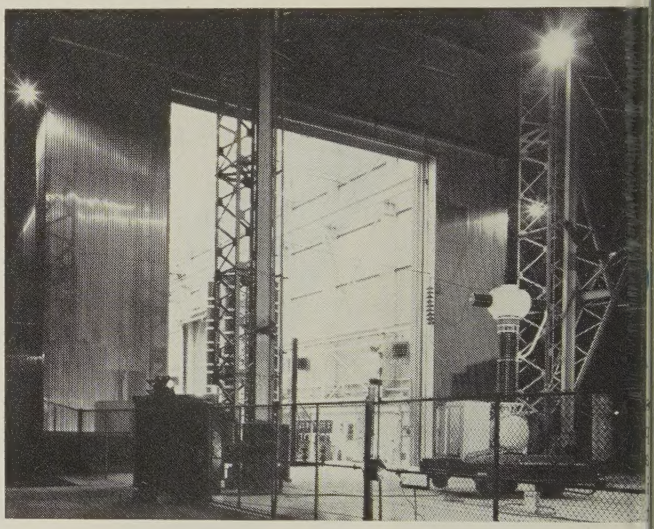
The Bureau of Ships has announced a change in the cost allocation of qualification tests for Specification MIL-I-631, Insulation, Electrical, Synthetic-Resin Composition, Nonrigid. The terminal date for tests at government expense is January 31, 1960. Qualification tests requested after that date will be at the expense of the manufacturer. Copies of this specification may be obtained from the Commanding Officer, Naval Aviation Supply Depot, 5801 Tabor Ave., Philadelphia 20, Attn: CDS.

"Teflon" TFE Resin Price Reduced

Another price reduction, the tenth in about 15 years, has brought the price of Du Pont's Teflon TFE fluorocarbon resin down to $3.60 a pound for the basic resin. This is about one-fifth the original introductory price back in the days when it was strictly a pilot-plant material. Another Teflon electrical insulation product, the new Teflon 100 FEP fluorocarbon resin, is being priced at $11.60 a pound in truckload lots and $13.00 a pound in minimum quantities.

Million-Dollar High Voltage Lab

A million-dollar high voltage testing laboratory, claimed to be the most advanced of its kind in the world and capable of generating up to 3,000,000 volts for impulse testing and 1,000,000 volts for indoor or outdoor 60-cycle tests, has been opened by General Electric Co. at the



switchgear development center in Philadelphia. At the new facility, engineers reportedly will be able to simulate the effects of lightning striking a power system at the instant high voltage power circuit breakers are operating to clear short circuits.

Sun Buys Facile

Although the purchase price was not revealed, it has been disclosed that Sun Chemical Corp., New York City, has bought Facile Corp., Paterson, N. J., in a cash transaction. Facile makes coated and laminated film and fabrics, some of which are used for electrical insulation purposes. For the fiscal year, Facile's sales are reported to approximate $5-million. It will be operated as a division of Sun Chemical with Eugene Jacobson, Facile's former president, remaining in charge.

Advertisement

New Insulating Varnishes—The Key to More Efficient Electrical Equipment

An Interview with Raymond H. Thielking, Technical Director, Schenectady Varnish Company, Inc., Schenectady, N. Y.

Increased production of molded or encapsulated motors and transformers has led to speculation about the future of insulating varnish systems. The following discussion defines the function of insulating varnishes and describes recent trends in equipment design which reaffirm the role of insulating varnishes as the key to improved electrical equipment.

Q. What are the main functions of insulating varnishes?

A. Varnishes are applied to supplement or improve other components of an insulating system. Depending on the requirements of the application, they can improve insulation life at higher temperatures, increase electric strength, extend the life of equipment exposed to humid, dusty or corrosive atmospheres or make possible the design of lighter equipment or components without reducing their efficiency. In many applications they also bond other components together and prevent movement of coils and subsequent failures due to abrasion and cut-through.

Q. What are the major types of varnishes and their applications?

A. The three major types of varnishes are: (1) air-drying, (2) solventless and (3) heat-reactive or polymerizing. The air-drying types are used primarily as protective coatings and for touch-up. The solventless types polymerize with heat into a void-free mass. They are used for intricate, small coils where freedom from voids and rigidity of the mass are required. The heat-reactive varnishes, which are used in the bulk of applications today, through-cure completely with heat. They contain solvents which are driven off during baking.

Q. What is the trend in electrical equipment design?

A. The steady progress of AIEE, ASTM and NEMA in setting temperature classifications above the old *105 C* (Class A) level, indicates the trend. Longer life at higher operating temperatures, smaller size without loss in efficiency — these are the main goals.

Q. What effect has this had on insulating varnish formulation?

A. The development of smaller, more intricate coils, rotating at higher speeds has in part been made possible by insulating varnishes with higher heat resistance and better bonding strength. The early oleoresinous varnishes gave way to the heat-setting phenolics and now the polyesters, epoxies and silicones are being used in increased volume.

Q. Which types of insulating varnishes now predominate?

A. Despite all the talk about Class B, F and H varnishes, the Class A thermosetting varnishes far surpass all others in total annual poundage produced. There is no question, however, that Class B and F varnishes are making significant inroads as more and more equipment is designed for operation at these higher temperatures.

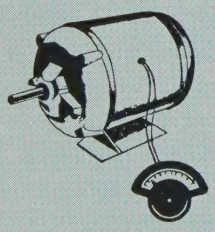
For example, ISONEL* Polyester Varnish, which is priced slightly above Class A varnishes, withstands temperatures up to 175 C when used with ISONEL magnet wire.** By contrast, the epoxies, which are more costly, are limited to 130 C at most. For these reasons, the polyesters have gained greater acceptance to date.

Q. Do encapsulated motors have any real advantages over conventional varnished motors?

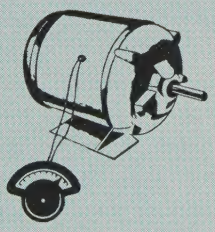
A. Yes. Encapsulated motors may have better moisture, chemical and weather resistance. However, because encapsulating materials are good thermal insulators, they also increase running temperatures. It is not unusual, therefore, for an encapsulated motor to show a 25-60% higher temperature rise than one of the same frame size insulated with a polyester varnish. The latter can be vented easier, hence made smaller, of simpler design and at lower cost. Heat-life is also significantly better. In our own company, we make a full line of varnishes and encapsulating compounds. So, "you pay your money and take your choice."

* Reg. T.M. Schenectady Varnish Company, Inc.

** Consult your wire supplier for data on ISONEL enameled wire.



Polyester varnish treated motors are easily ventilated and cooled. Result — lower temperature rise.



Encapsulating compounds hold heat. Result—higher temperature rise.

Inquiries should be directed to: Section E-01

In Canada: Schenectady Varnish Canada, Ltd.
309 Comstock Road, Scarborough, Toronto, Ont.

In Mexico: Schenectady Varnish de Mexico, S.A.
M. Antonio Casa No. 28 ler Piso B, Mexico 4, D.F.

SCHENECTADY VARNISH COMPANY, INC.

SCHENECTADY 1, N. Y.

INSULATING VARNISHES AND WIRE ENAMELS FOR THE ELECTRICAL INDUSTRY

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From the Editor

Opinions and Rambling Thoughts.

Looking Back and Ahead

Last month's 2nd National Conference on the Application of Electrical Insulation was undoubtedly a resounding success. This success was evident in the program quality, huge attendance, interest in commercial exhibits, and the remarkable turnout for all of the special events including the "Unity of Action" banquet and *Golden Omega* Award presentation. Future conference workers can look to the 1959 meeting as a model for efficient, high caliber conferences. General Chairman Harry H. Chapman, Jr., and all his co-workers on the 1959 meeting deserve the thanks of the industry for their outstanding efforts and accomplishments.

The conference was also noteworthy from the standpoint of the friendships which were renewed and the enmities which were forgotten. As a matter of fact, one electrical engineer and an insulation producer, longtime enemies, became fast friends during the conference. Unfortunately, this new-found rapport was put to the test on the last day of the conference when the insulation producer heard about the death of a destitute insulation salesman who had passed away after a costly, lingering illness. The insulation manufacturer appointed himself a committee of one to take up a collection for the salesman's burial. It was in this connection that he asked the electrical engineer:

"Could you give me a $1 bill to bury an insulation salesman?"

The engineer took out a $5 bill and said: "Here—bury five of them."

Such an incident may be rare at most conventions but there are some features and people which seem to be common to all mass meetings.

For instance, there is always that unobtrusive peeking at the name badge of the loquacious character who makes you suspect he must be some dear old pal from days gone by. Then, you finally get a close-up view of his badge and discover that he is Joe Bftllsk who is attending the 132nd annual conference of the Amalgamated Society of Russian Born Northern New Jersey Morticians, being held in the same hotel. At about the same time Joe gets a look-see at your badge and feels exactly as you do. You studiously ignore each other for the next three days.

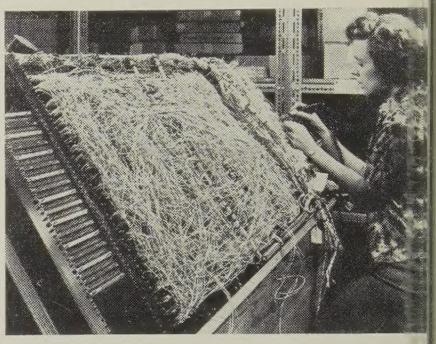
There is a definite art to reading the name badges of "old friends" without being detected. One method is to courteously flick an imaginary object of his lapel, remarking (as you sneak a quick glance at his badge), "This hotel certainly is loaded with bedbugs." This technique and remark not only cause the "friend" immediate discomfort but if you keep your eyes on him for the next few days you will notice his embarrassed scratching, spasmodic twitching, and frequent scrutinizing of his clothing. The bedbug lapel flick method is recommended for male friends only.

In cases where it is impossible to read the badge there are other ways of at least narrowing down the possibilities as to the identity of your "friend." For example, you say some disparaging things about your competitor, his product, and his mother. This is guaranteed to immediately identify your companion as a competitor or non-competitor. To narrow the possibilities down still further, you can make similar remarks about your best customer. You'll feel a special glow of pride in your talent for identifying people when that huge order is cancelled.

But instead of dwelling on the problems of conventions, there should be some mention of the good things that are ahead as far as conventions go. First, there is an important meeting this month at the Conrad Hilton Hotel in Chicago. It is the 16th Annual Technical Conference of the Society of Plastics Engineers being held January 12-15. There will be sessions on electrical insulation, new materials, radiation & missiles, and other subjects of interest to many insulation engineers. We urge your attendance.

The Society of the Plastics Industry is holding its annual meeting May 7-13 aboard the "Queen of Bermuda" on a New York to Bermuda cruise. To those who expect the conference to be one luxurious ball with no work and all play, be forewarned—it isn't. However, it will be difficult to convince your wife of this fact unless you take her.

This Looks Simple?



The industrial engineering department of Librascope, Inc., Glendale, Calif., has announced a production technique which simplifies wiring on large terminal bays used in computers. Rather than requiring a wireman to stand at a cabinet and wire the entire bay, the connectors have been grouped into three panels, which are individually wired at benches where the worker may sit and work under optimum lighting conditions. You can see how simple this all appears by examining the photo which shows more than just a couple wires. When the wiring is completed, the separated units are bolted into the cabinet to form one large bay and inter-connections between the panels are made.

Growth Industries

At the recent meeting of the National Electrical Manufacturers Association, economist Pierre A. Rinfret predicted that the top ten growth industries of the next decade would include electric utilities, missiles, electronics, and plastics. However, don't let this prediction give you too comfortable a feeling since both Dr. Rinfret and another economist also predicted that the economy will continue to have recessions.

GOOD CURRENT THINKING: PLYMOUTH CABLE TAPES

Thinking about current, since the turn of the century, has always included serious consideration of Plymouth cable and harness tapes. Plymouth Rubber special purpose and standard tapes have always been famous for reliability in the best current channels.

Plymouth tapes, made to specifications for the cable industry, adhere to the most exacting standards and are fabricated under the strictest quality control. Some typical examples are: GRS, butyl, neoprene, PVC, polyethylene, coated mylar, coated paper and laminated. Plymouth specializes in printed tapes, and adhesive and non-adhesive vinyl harness tapes in many colors.

Plymouth research stands ready to join you in developing the insulating, semi-conducting or harness-wrapping tape necessary to do your job *right*.

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Cable Tape Division

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QUALITY SINCE 1896 CANTON, MASSACHUSETTS

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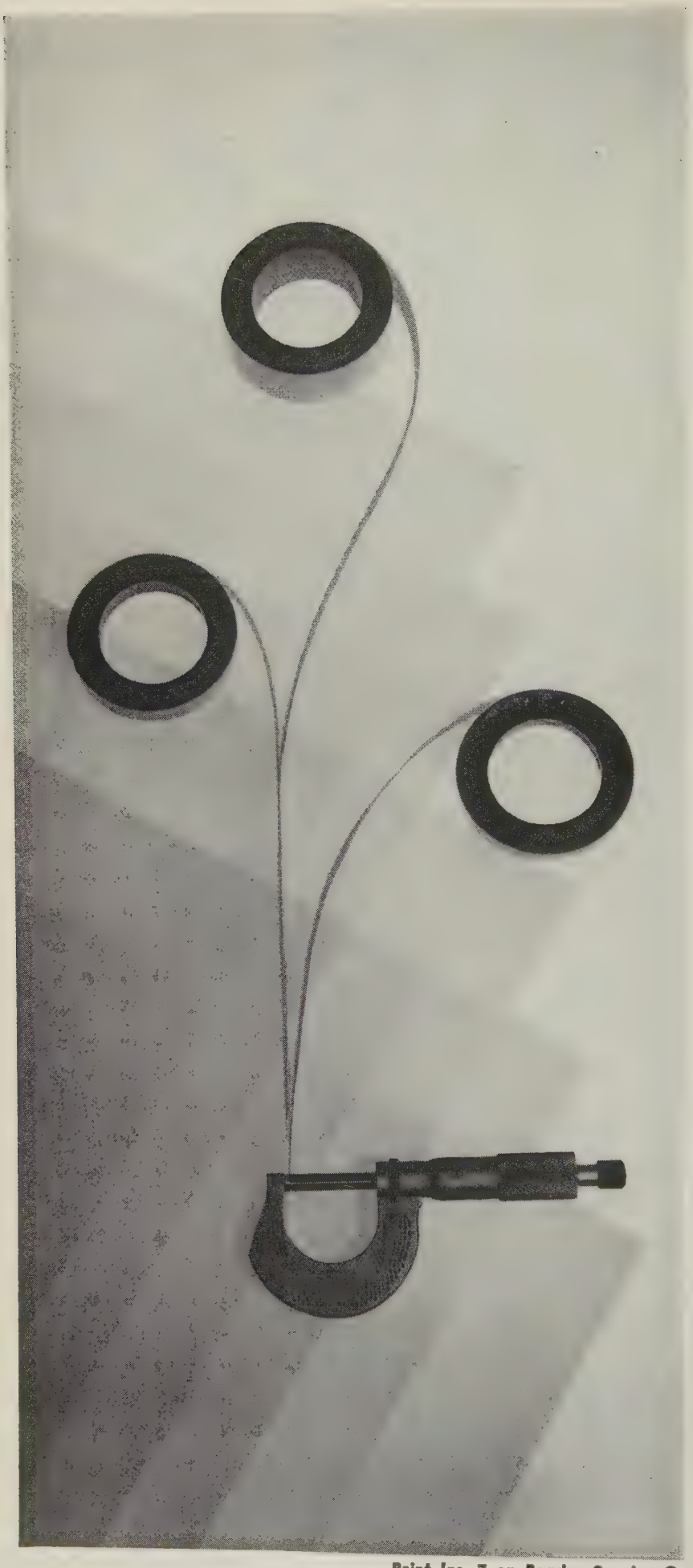

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by

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Today's design, production and service requirements call for electrical insulation materials of increased endurance — with higher dielectric values and greater physical stability. That is why it is more important than ever to use *customized* insulation in your product — insulation that is tailored to meet your specific requirements.

Electro-Tech has long been a leader in *customized* insulation materials for the development and construction of compatible electrical insulation systems. This leadership is based on the field-proven efficiency of such Electro products as Glas-Bes, Cyno-Glas, Dac-Var and others. It continues to grow with new products such as Sil-Bestos — a combination of silicone treated glass cloth with purified asbestos paper which is extremely suitable for layer insulation in transformers and slot cell insulation in rotating equipment.

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The Effects of Radiation on Materials

Part 1—Interaction of Radiation with Matter

By V. J. Linnenbom, Head, Radiation Effects Branch, Radiation Div., United States Naval Research Laboratory, Washington, D. C.

Introduction

The utilization of atomic energy for peaceful purposes today ranges from power generation to the production of literally hundreds of different radioactive isotopes for as many different applications. The use of atomic energy for power is especially significant to a world already concerned with the ever increasing rate of expenditure of energy from fossil fuels.

In operation at the present time are atomic power plants ranging in size from huge, land-based stations down through the smaller, more compact units used for nuclear propulsion of ships and submarines to tiny, atomic-powered batteries. Already on the drawing boards or in the prototype stage of testing are designs for more advanced applications, such as nuclear propelled rockets, and power stations in the Antarctic. Although the energy output of nuclear fueled plants is still quite small compared to other sources of heat and electrical power, it should be recognized that the application of atomic energy for power is still in the development stage. As this field continues to grow, its impact on the technological community will become more and more evident.

In particular, its effect will be felt by those concerned with the performance of engineering materials. To the usual requirements for physical and chemical stability of these materials (such as mechanical strength or corrosion resistance at ambient temperature) there must now be added another requirement, that of radiation stability. The design engineer in the atomic energy field must now ask himself, "What are the effects of radiation on the materials I propose to use?" More particularly, with reference to materials having a specific function to perform, such as electrical insulation, he will be concerned with such effects as changes in electrical resistance during irradiation, embrittlement of plastics, increased oxidation rates accompanied by increased degrees of degradation, dielectric breakdown, and many others. For those who are as yet unacquainted with the processes responsible for such effects, this and subsequent articles will serve as a brief introduction to the subject of radiation effects on materials.

Characteristics of Radiation

Radiation may be conveniently divided into two general categories: electromagnetic (zero rest mass) and particulate (finite rest mass). The spectrum of electromagnetic radiation includes, in order of increasing energy, radio waves, infrared, visible light, ultraviolet, x-rays, and gamma rays. To the particulate class belong electrons, protons, neutrons, alpha particles, beta particles, and others which need not concern us here.

In radiation effects work, however, one is concerned with what is loosely described as "ionizing radiation." This term refers to any type of radiation, either electromagnetic or particulate, which is capable of producing ions in the material through which it passes. This definition excludes all electromagnetic radiation in that part of the spectrum from ultraviolet down to radio waves, since the energies available in this region are insufficient to cause ionization of atoms. It is true that ultraviolet radiation (in sunlight, for example) may cause degradation of certain materials, such as plastics and other organics, but these photochemical changes are by convention not included in what is nowadays thought of as the radiation effects field. Ionizing radiation therefore includes x-rays, gamma rays, and the various types of particulate radiation previously mentioned. Since this discussion is concerned only with ionizing radiation, the term radiation when used in the following will be understood to refer to ionizing radiation.

We should not be misled by the descriptive term "ionizing," with its implied emphasis on the ionization process. Ionization, or the loss of an electron by an atom or molecule, is not the only process which occurs when ionizing radiation passes through material. Excitation also results. This is the process whereby an electron in an atom or molecule gains energy without being ejected. In many cases, excitation is as important in producing radiation as ionization. These two distinct processes always occur simultaneously when ionization radiation interacts with matter.

Both x-rays and gamma rays are alike in nature, having zero charge and zero mass. It is customary to distinguish between them on the basis of their origin. X-rays are considered as originating from the atom as a whole, and are always produced whenever high speed electrons strike a target. Two different mechanisms of x-ray production take place simultaneously: (a) The high energy electron may knock out one of the electrons occupying an inner shell of the target atom and an x-ray is subsequently produced when one of the atom's outer electrons falls into the vacant inner shell. Such x-rays always occur at certain definite energies, characteristic of the target element. (b) The electron as it approaches the nucleus of one of the target atoms will experience an accelerating force, and as a consequence will radiate energy in the form of electromagnetic radiation. These x-rays are found to be spread over a continuous spectrum of energies, and comprise the greater part of the total x-radiation produced. In commercial type x-ray machines, the x-rays may have energies ranging from a few ev to 100-200 kev*. Gamma rays, on the

other hand, originate in the nucleus of an atom, and are produced when the nucleus goes from a highly excited state to a lower level. They are usually in the mev energy range.

From the standpoint of radiation effects studies, a distinction between x-rays and gamma radiation on the basis of their origin is really unimportant. The significant thing to consider is the energy level of the radiation, since this is what determines the effect produced. A "hard" (or penetrating) x-ray may often be more energetic than a "soft" gamma ray. However, in accordance with long established usage, the two terms continue to be employed, referring not only to their method of production but also to their energy. In most cases, the term x-ray implies electromagnetic radiation with less energy than gamma rays.

One of the most commonly used sources of gamma radiation today is Cobalt-60, made by irradiation of metallic cobalt in a reactor. The naturally occurring cobalt isotope of mass 59 absorbs a neutron to form the radioactive isotope of mass 60, which decays, or dies away, with a half-life** of 5.3 years. Each radioactive atom of Co-60 which decays produces two energetic gamma rays in the process, at energies of 1.1 and 1.3 mev, respectively. Because of its long half-life, Co-60 sources are very widely used today in many laboratories for radiation effects studies.

Another powerful gamma source, but somewhat less widely used, is an array of used reactor fuel elements. When discharged from a reactor, the fuel elements contain large quantities of radioactive fission products, and are usually set aside to "cool" for a period of several months before reprocessing. During this time, the decaying fission products give off tremendous quantities of gamma radiation, and a very potent gamma source can be set up by arraying the fuel elements under water in a pattern so as to give a fairly uniform gamma radiation field. Because of problems in handling and transportation, this type of facility is to be found mainly at AEC installations.

As time goes on, more consideration is being given to the fission products themselves as a source of gamma radiation. During the reprocessing of the uranium which is used as reactor fuel, a necessary step is the chemical separation of the fission products. This "radioactive waste" at present has little usefulness, and is being stored by the AEC until it decays away. Several design studies have already been made in which the gross mixture of fission products is used as a radiation source. In addition, consideration is being given to separated fission products such as cesium-137, which decays with a half-life of 30 years (as compared to 5.3 years for Co-60), emitting a 0.7 mev gamma ray in the process. At present, its only advantage over Co-60 is its longer life, since the latter isotope releases four times as much energy per decaying atom as does Cs-137. However, the AEC has recently announced a reduction in the price of separated cesium, which makes it economically more competitive with Co-60. Furthermore, from a future standpoint, it must be remembered that as more reactors go into operation, more and more Cs-137 will become available, and the economic picture may change still further in its favor.

And, of course, an operating reactor is itself a powerful gamma source. Not only do accumulated fission products emit gamma radiation, but the fission process itself produces highly energetic gamma rays during the act of fission, or splitting of the uranium nucleus. Absorption of neutrons by surrounding materials also results in futher production of gammas. However, a reactor always produces a mixed radiation field of neutrons plus gammas. For studies limited to the effects of gamma radiation alone, or for those where the question of dosimetry is important, a Co-60 source is superior.

High energy x-rays have also been produced for irradiation purposes by allowing the energetic electrons from a Van de Graaff generator or a linear accelerator to strike a target such as gold. This is a particularly useful technique when fairly large volumes of material are to be irradiated.

From the standpoint of radiation effects, neutrons are one of the most important of the particulate types of radiation. These particles are of nuclear origin, have a mass approximately that of a hydrogen atom, and have zero charge. They are always present as an important part of the radiation environment in and around a reactor where they are produced during the fission process. Consequently, all materials used in the construction and instrumentation of reactors must be carefully selected from the standpoint of stability toward neutrons. The reactor is by far the most important source of neutrons for radiation effects studies. Neutrons of high energies can also be produced by accelerators, but they are used more for nuclear research than for radiation effects work. However, if monoenergetic neutron beams are desired, accelerators must be used, since the spread in energies of the neutrons found around a reactor may vary from less than one electron volt to several mev.

Electrons are also a very important tool in the investigation of radiation effects. These particles are one of the elementary building blocks of matter, having a mass of about 1/1850 that of a hydrogen atom, and possessing a unit negative charge. Various types of machines are used today to produce electron beams of varying energies such as linear accelerators, Van de Graaff generators, betatrons, etc. Of these, the Van de Graaff is one of the most useful and practical. A typical model produces a 200 micro-amp, 2 mev electron beam, which may cover a target area up to several square centimeters.

Beta particles are distinguished from electrons only by the fact that they originate in the nucleus of an atom during radioactive decay, and are emitted with varying energies. Artificial beta sources made up of radioactive material are sometimes used

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*The energy level of ionizing radiation is expressed in units of electron volts, which is the energy required to bring one electron from zero potential to a potential of one volt. In other units, 1 ev = 1.6×10^{-12} ergs = 3.8×10^{-20} calories. Because of the small magnitude of this unit, it is customary to use the units "kev" (a thousand electron volts) and "mev" (a million electron volts).

**The half-life is defined as the time it takes for a given amount of radioactive material to decrease to half that amount by the decay process.

or special radiation effects studies, ut in general such electron source is ecidedly inferior to a machine such s a Van de Graaff.

Protons are particles with a mass qual to that of a neutron, but with nit positive charge. They are pro-uced by bombardment of a suitable aterial by other particles. As a pri-ary source of radiation in radiation ffects studies, protons are not very ractical due to their extremely lim-ed penetrating power. However, they re sometimes produced directly in ie material of interest, and when this appens they can produce noticeable ffects. For example, a sample contain-ig hydrogen when irradiated with eutrons will produce "knock-on" pro-ons, or hydrogen nuclei knocked out f place by collision with the incoming eutrons. Similarly, when materials ontaining nitrogen, such as certain lastics or animal tissue, are irradi-ted with neutrons, protons are pro-uced by a process in which a neutron absorbed by a nitrogen nucleus and proton is emitted, leaving behind a adio-active carbon nucleus. In either ase, the protons are formed through-ut the material and are often respon-ble for a considerable part of the ob-erved radiation effects.

Alpha particles are helium nuclei, eing made up of two protons and two eutrons, with a mass equal to that of our hydrogen atoms, and possessing positive charge of two. These are roduced during radioactive decay nd are emitted from the nucleus with airly high energies of from 3-8 mev. ike the proton, alphas have a very mited penetrating power, and in ra-iation effects studies are of impor-ance only in special cases.

The relative costs of some of these adiation sources are of some interest.)f the available gamma sources, Co-60 eems to be the least expensive and the ost convenient. At the present AEC rice of $2000-$5000 per kilocurie*, epending on the number of curies per ram of cobalt, Co-60 is cheaper in erms of cost per unit of available nergy than any other device except large accelerator. However, since the capital cost of the latter is very much larger, and a much longer delivery time is involved (as compared to ready availability of Co-60 from stock-piles at Oak Ridge), a Co-60 source has the advantage in overall cost and availability. Radiation effects studies are being carried out at the present time with Co-60 sources ranging in size from a few hundred to several thousands of curies. It should be pointed out that for Co-60 sources, the cost of the material itself is sometimes a minor part of the total cost of the irradiation facility. The necessity for heavy shielding, remote handling of the source, and similar considerations often cost more than the source itself.

A Van de Graaff machine for production of high energy electron beams might cost from about $80,000 for a 2 mev machine to roughly $200,000 for a 5 mev machine. In cases where a higher energy electron beam is necessary (for example in some of the proposed schemes for sterilization of food by radiation), a machine known as the traveling-wave electron accelerator may be required. This machine produces electrons with energies up to 50 mev, at an overall cost ranging from about $150,000 to $700,000.

Reactors for material testing purposes are of course very expensive. This is because much greater numbers of neutrons are needed for materials testing than are available in the cheaper research type reactors, such as the so-called swimming pool reactor. While the latter may cost from $500,000 to $750,000, the testing type reactor cost is so great as to prohibit all but the government and a very few of the largest industrial concerns from building them. Smaller laboratories find it much more practical to rent irradiation space in one of the existing test reactors.

Interaction of Radiation with Matter

The ionizing effects of radiation may be demonstrated very simply. It is well known that under ordinary conditions gases such as air are very good electrical insulators. If a gold leaf type of electroscope is given an electrical charge, mutual repulsion will cause the two leaves to separate. A very gradual loss of charge on standing will then occur, and eventually the leaves will come together. However, if any radioactive material is placed nearby, or if the electroscope is exposed to x-rays, the rate at which the leaves lose their charge and come together is very much increased. This is attributed to an increase in the conductivity of the air caused by the ionizing radiation, which produces free electrons and positive ions in the gas, thus allowing the charge to leak off the leaves more rapidly than in the absence of the radiation. The gradual leakage of charge on standing, even in the absence of radiation sources, is due to the ionizing effect of naturally occurring cosmic radiation.

In considering the mechanisms involved when radiation interacts with matter, it is convenient to consider electromagnetic radiation as being made up of particles or bundles of energy called photons. It is also convenient to distinguish between the primary reaction between the incoming particle of radiation and a given atom, and secondary processes which are set in motion as a result of the primary interaction.

When any particle of radiation comes close enough to an atom, it is either scattered or absorbed. In either case, energy is transferred from the incoming radiation to the material. For example, when a beam of electrons impinges on matter, there is a high degree of repulsion between the electrons in the beam and the constituent electrons of the atoms being bombarded, since the reacting particles in this case have the same negative charge. The result is scattering of the incoming beam, generally in the forward direction, with the atomic electrons being either ejected altogether from the atom or excited to a higher energy level within the atom. The electron ejected as a result of the primary interaction possesses considerable kinetic energy and will in turn cause further ionizations and excitations in other nearby atoms. The electrons produced as a result of these ionization processes are known as secondary radiation, while the incoming beam of electrons is called primary radiation.

In the case of irradiation with neutrons, however, there is no electro-

A curie is that quantity of any radioactive material which gives 3.7×10^{10} disintegrations per second.

static interaction since the neutron has no charge. Consequently nothing happens until the neutron gets very close to the nucleus of an atom. At this point, short range nuclear forces (of which very little is known) become operative, and the neutron may be either absorbed by the nucleus or it may be scattered. When absorption occurs, the nucleus is left in a highly excited state. Part of this excitation energy is emitted almost instantaneously as highly penetrating "capture gamma" radiation. The residual excitation energy is released at some later time, usually in the form of beta particles. This radioactive decay process results in the appearance of a new nuclear species, and the end result of neutron absorption is the transmutation of one element into another. Capture probabilities, or cross-sections, differ not only from element to element, but also vary considerably for isotopes of the same element. In general, capture is most probable in the case of the so-called thermal neutrons, i.e., neutrons whose energy distribution is approximately that of gas molecules in thermal agitation at room temperature. Fast neutrons, on the other hand, are more likely to be scattered than absorbed; each scattering process reduces the energy of the neutron until it is eventually thermalized and captured. Hydrogen atoms, having the same mass as a neutron, are the most efficient of all atoms in reducing the energy of a neutron by scattering, and hydrogenous materials are thus very effective in slowing down the fast neutrons produced in reactors or accelerators.

When gamma photons interact with matter, one of three possible primary reactions occurs, depending on the energy of the photon. At low energies, the photon may interact with one of the bound electrons of an atom, as a result of which the photon is completely absorbed and the electron is emitted with a kinetic energy equal to the initial energy of the photon less the work required to remove the electron ("binding energy" of the electron). This reaction is called the "photoelectric" process, and is favored when the photon energy lies between a few kev and about 0.1 mev. However, for higher photon energies, up to about 3-5 mev, scattering of the gamma radiation takes place. The "Compton scattering" process, named after its discoverer, has been likened to a billiard ball type of collision. The photon reacts with one of the electrons in the material, producing a so-called recoil electron and a photon of reduced energy. For very high energy photons, several mev and higher in energy, interaction with matter takes place via the "pair production" process. The bundle of electromagnetic energy called the photon is converted instantaneously into mass (for reasons not entirely clear), producing an electron and a positron (a particle similar to the electron, but with unit positive charge). Any energy of the photon in excess of 1.02 mev (the energy equivalent of the rest masses of the two particles produced) appears as kinetic energy of the particles.

It should be pointed out that the relative probabilities of photoelectric absorption, Compton scattering, and pair production depend not only on the photon energy, but also on the atomic number of the interacting atoms. Thus the probability of the photoelectric process occurring is proportional to the fifth power of the atomic number. This means that in a heavy shielding material such as lead or tungsten, photoelectric capture is much more probable than in lightweight materials such as plastics.

For positively charged particles like alphas or protons, capture by an atomic nucleus is relatively rare. The main processes which occur are either reactions with the electrons of an atom, the electrons being scattered and the alpha (or proton) being eventually brought to rest or, less frequently, scattering of the alpha by the atomic nucleus.

Table 1—Comparative Penetrating Power of Charged Particles

Particle	Energy (mev)	Range (inches) Air	Water	Aluminum
alpha	1	0.2	0.0002	0.0001
proton	1	0.9	0.001	0.0005
electron	1	104.	0.14	0.06

An important part of the picture i the interaction of radiation with ma ter involves the range, or penetrati power. An alpha particle, being rel tively massive and highly charge interacts so strongly that it penetrat only a slight distance before bei stopped completely. However, in tra eling this small distance, it still mu give up a large amount of energy, pr dominantly by interaction with an scattering of electrons. This results i a very high density of ionization; tha is, very large numbers of electrons an positive ions are produced per un path length of the alpha particle. Sim lar considerations hold true for pr tons. Electrons, although charged, a less massive, and penetrate further. follows that for electrons successiv interactions are spaced further apa than for alphas or protons. Table lists some ranges for charged particl in various materials.

Another way of comparing the rel tive ranges of the three charged pa ticles in table 1 is by saying that takes a 17 mev proton or a 68 me alpha to penetrate the same distan in matter as a 1 mev electron. Th conclusion to be drawn from thes data is that alphas and protons are little use in radiation effects work e cept in very special cases, such as study of surface effects.* Electron however, can be used for volume e fects work when they are at fair high energies.

Electromagnetic radiation, on th other hand, is highly penetratin Similarly, a neutron, being electrical neutral, can travel relatively far b fore being reduced in energy an eventually captured. Neutrons, x-ray

*This statement applies to the case where an exter beam of particles is used. If an alpha-emitting rad active source can be distributed uniformly through the material, the situation is different.

Table 2—Radiation Terms and Units (Ref. 1)

Term	Definition	Remarks
energy flux (intensity of radiation)	The energy per unit time entering a sphere of unit cross-sectional area (in erg/cm²-sec or watt/cm²).	The word "flux" implies that all particles count, irrespective of direction.
number flux	The number of particles per unit time entering a sphere of unit cross-sectional area.	Used particularly to describe a neutron field. Fails to give information about energy distribution of particles, if any.
absorbed dose	The energy imparted to unit mass of material at the point of interest.	Refers to *any* ionizing radiation but for a particular material.
exposure dose	A measure of the ability of a radiation field to produce ionization in air.	Restricted at present to x- and gamma radiation.
rad	Unit of absorbed dose; 1 rad = 100 ergs/gram.	Cannot be used to describe a radiation field.
roentgen	Unit of exposure dose; that amount of x- or gamma radiation which produces in 1 cc of air under standard conditions (.001293 g. air) 1 esu of electricity of either sign.	Equivalent to 87.7 ergs* absorbed per gram of air. Applicable *only* to x- and gamma radiation.
rep (roentgen equivalent physical)	The amount of *any* radiation which deposits 93 ergs in 1 gram of animal tissue.	Describes *any* radiation field by its effects on a standard material.
rem (roentgen equivalent man)	The amount of *any* radiation which produces the same biological effect as one roentgen of x- or gamma radiation.	Involves the use of complex factors pertaining to the biological effectiveness of a particular kind of radiation. Not recommended for use in materials effects studies.

Latest revised value; previous value was 83 ergs absorbed per gram of air which is equivalent to 93 ergs absorbed per gram of tissue, upon which was based the definition of the rep.

nd gamma radiation are attenuated xponentially in passing through matr, and consequently it is impossible fix a definite distance of penetation as can be done for the harged particles. In such a case, one sually compares the relative stopping owers of materials by giving "half-hickness" values, that is, the thickess necessary to reduce the intensity f the radiation to one-half its original value. Thus, for a 1 mev gamma, he half-thicknesses of water, concrete, nd lead are 4 in., 1.8 in., and 0.35 n., respectively. It will therefore take everal inches of lead, or several feet f concrete, to effectively shield gainst the very penetrating gamma adiation. As the energy is reduced, he necessary thickness for shielding also reduced. Thus, a 10 kev x-ray ill travel only 6 to 8 feet in air (as ompared to hundreds of feet for a 1 mev gamma), and only a fraction of an inch of aluminum is required for shielding.

Since neutrons are attenuated by collisions with atomic nuclei, rather than by electron interaction as are gammas, a heavy material such as lead is not very effective shielding against fast neutrons. The neutrons suffer very little energy loss in collisions with lead atoms (similar to a collision between a small rubber ball and a heavy metal object), and although scattered continue on unabated. Hydrogenous materials, such as water or plastics, are most effective in shielding against fast neutrons, since hydrogen nuclei and neutrons have the same mass. Consequently, it takes only one or two feet of polyethylene to effectively slow down a 1 mev neutron beam, whereas it takes several feet of concrete and several hundreds of feet of air to achieve the same end. What this means in radiation effects work is that large volumes of material can be effectively irradiated with either gammas or neutrons.

All of the primary interaction processes discussed above are thus seen to result in production of secondary radiation within the material, in the form of either scattered electrons or positively charged recoil ions. This is true regardless of whether the primary radiation consists of neutral neutrons, photons, positively charged alphas, or a beam of negatively charged electrons. These scattered electrons and recoil ions subsequently give up their energy to the material through further ionization and excitation processes. It is this so-called secondary radiation produced within the material which is responsible for most of the observed radiation effects in materials. A single

Table 3—Radiation Sources

Source	Type of Radiation	Size	Radiation Field
Co—60	gamma	kilocuries	up to 10^6 r/hr
Separated fission products	gamma	kilocuries	up to 10^6 r/hr
Spent reactor fuel elements	gamma	varying	up to 10^7 r/hr
reactor	gamma neutrons	varying	up to 10^{10} r/hr $10^{11} - 10^{15}$ n/cm^2-sec
Van de Graaff accelerator	electrons	200 micro-amp at 2 mev	10^{10} rep/hr
cyclotron	protons	200 micro-amp at 10 mev	10^{11} rep/hr
X-ray machines	soft x-rays, low penetrating power	less than 100 kilovolts	up to 10^8 r/hr
X-ray machines	hard x-rays penetrating	1 million volts or more	up to 10^7 r/hr

primary interaction, for example, which results in ejection of an electron from an atom or molecule may be responsible for a host of secondary processes, since the ejected electron may produce many more ionization and excitation processes before its energy is finally expended.

To summarize, the interaction of the various kinds of ionizing radiation with matter leads to production of energetic positively charged ions and energetic electrons within the material. Both types of particles in turn give up their energy to the material through the processes of ionization, excitation, and, to a minor extent, displacement of atoms. The major portion of the energy transferred to a material is expended through ionization and excitation processes.

Radiation Units

In attempting to express quantitatively the relation between effects produced in a material and the amount of radiation to which it has been exposed, one starts with the basic assumption that only the energy actually imparted to the material by radiation is effective in producing changes. Obviously, radiation which passes through the material without interaction (i.e., without transferring energy by one of the processes discussed above) can produce no effects. The term "dose" is used to describe the extent to which the radiation interacts with the material. Absorbed dose is then a measure of the energy actually absorbed by the material. The unit of absorbed dose is the "rad," defined as the absorption of 100 ergs of energy per gram of the particular material being irradiated, without regard to the kind of ionizing radiation. This unit is particularly useful in correlating radiation effects data, since radiation effects in many materials (organic compounds such as plastics, elastomers, oils, greases, etc.) depend primarily on the energy absorbed.

Unfortunately, the word "dose" has also been used to describe the radiation field to which a material has been exposed. It is therefore necessary to distinguish between "exposure dose," pertaining to the radiation field, and "absorbed dose," pertaining to energy absorbed by the material. Several methods may be used to describe a particular radiation field. One is a "number flux," in which the number of particles passing through unit cross sectional area is given. Another is "energy flux," in which the energy incident upon unit area is given, in units of ergs/cm^2, or mev/cm^2. These units suffer from a serious shortcoming in that they fail to describe the field completely; thus, a neutron flux expressed as neutrons per cm^2 per second tells us nothing about the different energies of the various neutrons. A third method is to describe the radiation field in terms of the effects produced in a standard reference material. For example, a gamma (or x-ray) field is described in terms of the ionization produced in air under standard conditions; the unit used is the "roentgen," which is equivalent to deposition of 87.7 ergs per gram of air. Table 2 lists the various units plus their definitions.

It should be emphasized that in a given radiation field, absorbed dose depends on the composition of the particular material being irradiated. For example, in a gamma radiation field of one roentgen, air will absorb 0.87 rads, whereas water will absorb 0.97 rads. This shows that a radiation field described in terms of energy deposited in a standard reference material may often impart different amounts of energy to other materials, producing a difference in the effects observed. This is especially true for mixed fields, such as exist in reactors. It is often difficult if not impossible, to correlate results obtained on a given material irradiated in different laboratories with different radiation fields unless the energy actually absorbed by the material is given. This limits the usefulness of units which describe the radiation field alone.

On the other hand, the effects produced in many materials (metals, ceramics, semiconductors) are not proportional to the total energy absorbed. For these materials the concept of absorbed dose in rads as a measure of the particular effect

udied is no longer valid. When such the case, an attempt must be made express the interaction between the diation and the material in other nits. For example, when a metal is radiated in a reactor, the most damging component of the radiation field the fast neutron flux; it is customy in this case to express the exposure terms of a time-integrated number ux, i.e., fast neutrons per cm^2. An en better description would include me information as to the energy ectrum of these neutrons.

To give some feelings for the relaon between the various radiation nits, the following approximation ay prove helpful:

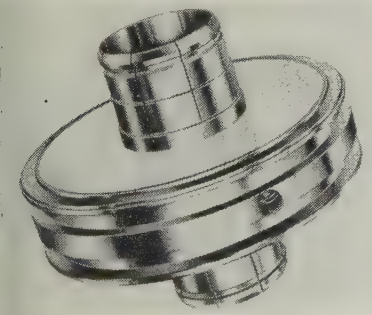
rep $\cong$ 1 roentgen
$= 10^{10} - 10^{11}$ slow neutrons/cm^2
$= 10^8 - 10^9$ fast neutrons/cm^2
$= 2 \times 10^9$ 1 mev photons/cm^2
$= 5 \times 10^7$ 1 mev electrons/cm^2

n order to produce measurable effects a plastic such as polyethylene, an sorbed dose of about 2×10^7 rads necessary which is equivalent to out $10^7 - 10^8$ rep.

Table 3 lists some typical sources nd the radiation fields produced.

Styrene Insulates BMEWS Coaxial Lines

A high-dielectric constant styrene o-polymer which may be machined close tolerances (0.005″ or less) is eing used as a gas barrier and dielectric in coaxial transmission lines the nation's furthermost polar dense line, BMEWS. The dielectric



aterial, "Rexolite," is said to be almost totally impermeable to moisture, esists crazing at temperatures lower han —50°F and, besides its ease of achining, can be cemented readily. is supplied by the Rex Corp., West cton, Mass.

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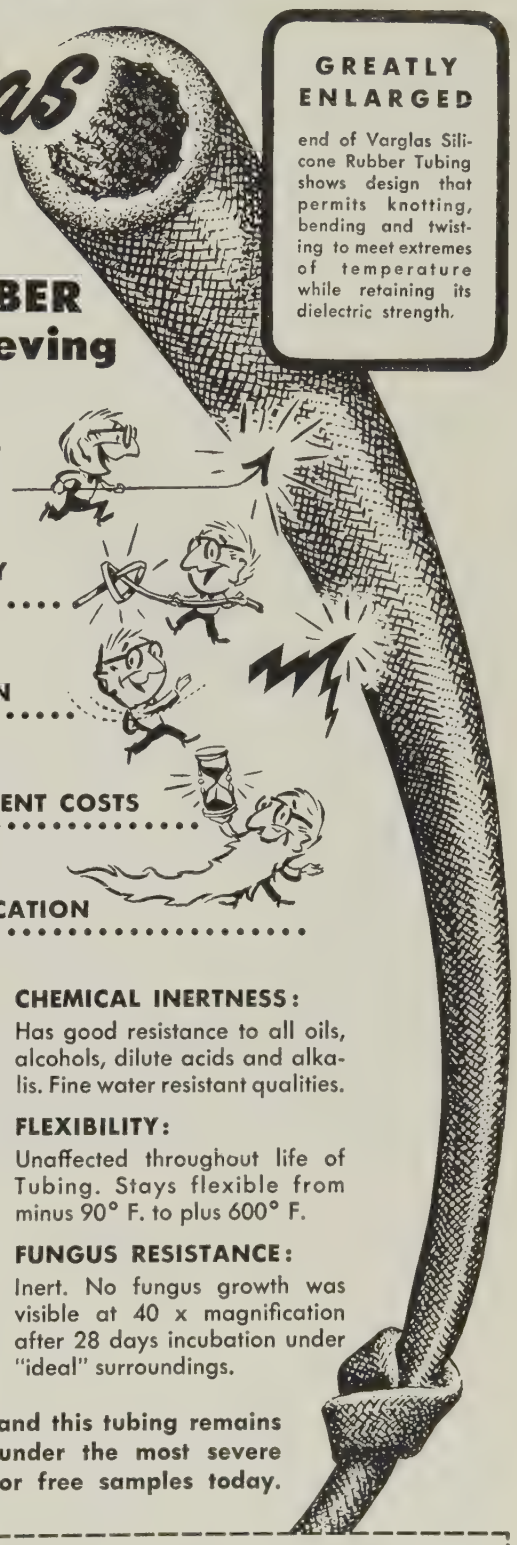

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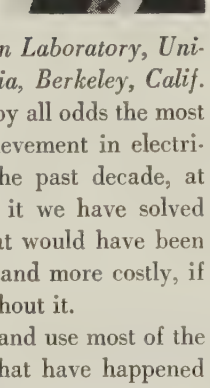
Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What do you think has been the most notable achievement in the field of insulation during the past decade?



James O. Turner

Lawrence Radiation Laboratory, University of California, Berkeley, Calif.

"Epoxy resin is by all odds the most notable single achievement in electrical insulation in the past decade, at least for us. With it we have solved many problems that would have been very much harder and more costly, if not impossible, without it.

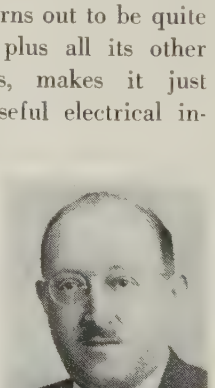
"We appreciate and use most of the wonderful things that have happened in many other materials such as ceramics, rubbers, fibers, fluids, and plastics (polypropylenes, phenolics, and 'Mylar'). In fact, we depend almost completely on Mylar for wrapping large copper bar conductors and heavy electrical assemblies that cannot be potted but must be protected from rough handling.

"However, for sheer versatility and all-around sturdiness in uses around this laboratory, nothing else is in the same ball park with epoxy. We pot coils from thimble size to those weighing tons. Long strings of fragile ceramic resistors are coiled up and imbedded in a soft epoxy compound to reduce corona at high voltage. Epoxy castings are used for voltage-gradient control in high-voltage cable pot heads, and for high-voltage isolation in vacuum-tank walls. They are used for lead-through bushings in pressure and vacuum vessels, and in a good many other roles that once could be filled only by ceramics.

"At one point we needed, on short notice, some lead radiation shielding for use in a rapidly changing magnetic field. It had to be nonconducting to prevent eddy currents. Epoxy bricks with lead powder filler provided a quick and easy answer. Corona-free, high-strength insulating bolt anchors are made simply by setting ball-shaped bolt heads into holes filled with the resin. Where castings are not quite strong enough, we use epoxy resin and fiber glass lay-ups.

"We build a lot of insulating structures from industrial laminates in sheet, rod, and tube form. Again the toughest jobs fall to epoxy in the form of NEMA grade G-10 material. Its balance of electrical, mechanical, and vacuum properties is so good that we have an ironclad rule that no other nonmetallic may be used in and around the vacuum tank (the heart) of the big Bevatron without special permission. The printed circuits that we use are largely done on G-10, for these same reasons.

"I expect that high-volume producers will have other ideas because of the high cost of epoxy. But for us, material cost is usually very small compared to labor cost. We can do so many things so easily with the use of epoxy, that it turns out to be quite economical. This, plus all its other magical properties, makes it just about our most useful electrical insulating material."



Leonard Milton

Executive Vice President, Filtron Co. Inc., Flushing, N. Y.

"The greatest single achievement in insulation of capacitors in the past decade was the development of capacitor-grade "Mylar" film by Du Pont. This film has three outstandin electrical characteristics when used a a dielectric material for capacitors 1) Very high dielectric constant, 2 exceptional insulation resistance, an 3) very high dielectric strength.

"In addition to these electric cha acteristics, it exhibits the followin superior physical characteristics: 1 Film is available as thin as .0002 2) Relatively static free, makin winding a simple operation. 3) Pin hole free, thus permitting the use one single film between foils.

"Thus the introduction of Myl made possible the production of sub miniature capacitors of relatively hig reliability. Also, the use of Mylar film in combination with capacitor Kra tissue, as well as other films, adde considerably to the dielectric strengt and therefore to the life of capacitor manufactured in this manner. Thu in effect, Mylar opened a new era o high reliability capacitors of hig voltage and high temperature ratings."

M. S. Pennington

Design Engineer, Southwestern Industrial Electronics Co., Houston Texas.

"From my viewpoint, the develop ment of epoxy-based insulation sy tems represents the most importan advance in insulation in the last dec ade. As designers and manufacturer of small transformers, the propertie of a properly chosen epoxy syste come close to ideal answers to som of our problems.

"We are concerned with miniatu izing both military and commercia units from the smallest up to 10 KV rating. Reliability, weight, and co are, of course, other important co siderations. With epoxy systems avai able today, we find that a relativel straightforward approach can be take to yield units conforming to Mil- 27A, Grade 5, Class T, Life X.

"Even a few years ago, materia and techniques were not commerciall available for such conditions. To th best of my knowledge the building such units became possible within th decade, first under laboratory cond tions, and presently on a routin production basis."

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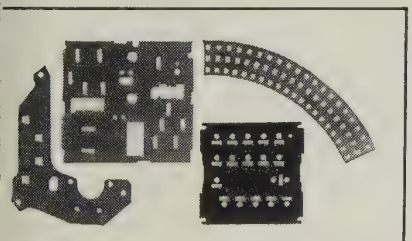

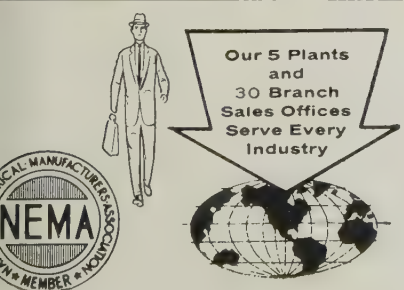

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Three tiers of head tables at the Unity of Action banquet were occupied by guest speakers, committee officials, and honored guests.

Insulation Conference Repor

Despite huge attendance, a large advance registration and smooth operating procedures made registration a quick and simple task.

The 2nd National Conference on the Application o Electrical Insulation can only be termed a great success Nearly 1700 registered for the technical meetings an 1200 attended the Unity of Action banquet. The photo presented on the following pages will give you a good ide of the enthusiasm, interest, and satisfaction evidenced b those visiting the exhibits or participating in technic meetings and committee work.

Rickover Stars at Banquet

Those attending the Unity of Action banquet in hope of hearing something of value were not disappointed. Vic Admiral Hyman G. Rickover, USN, after being presente with the *Golden Omega* award for his contributions t scientific technology, received a standing ovation for h terse and hard-hitting, but constructive, criticism of i dustrial standards. In addition, he was asked to return t the rostrum twice; first to outline his views on bureaucra

Unity of Action banquet, the high point of the conference, was attended by nearly 1200.

THE GOLDEN OMEGA AWARD

Presented December 8, 1959 to

VICE ADMIRAL HYMAN RICKOVER, U S N

in grateful recognition of his outstanding achievements in the use of nuclear power and the improvement of electrical equipment design. Resolution and firmness of belief have characterized his unceasing efforts. His accomplishments have figured significantly in the technological progress of his country.

Presented on behalf of America's men of science and industry and the users and producers of electrical insulation. Sponsored by Insulation *magazine.*

Citation presented to Admiral Rickover with the Golden Omega *award.*

Orderly registration lines moved smoothly.

Secretary of the Army Wilber C. Brucker delivered the principal address at the Unity of Action banquet.

The Marketers' Meeting began Monday with a well-attended luncheon.

An outstanding speech at the Marketers' luncheon was presented by Dr. Kenneth McFarland.

A. S. Gray, Insulation Manufacturers Corp., presented Miss Lenore Prehler, daughter of the late Henry P. Prehler, with a scroll in honor of her father who had been chosen to receive the first Marketers' Award.

and then to talk on education in the United States.

His talk was concise and to-the-point, liberally illustrated with actual examples of cases in which industrial standards, including some insulation specifications, had failed to do their intended job. He proposed that technical committees preparing standards be composed primarily of *users* rather than of *manufacturers*. His prepared speech is presented verbatim at the end of this report.

In speaking about bureaucracy, Admiral Rickover said that the determining factor in the struggle for supremacy between Russia and the USA will be the comparative efficiency of their bureaucratic systems. He asserted that the USA system is hampered by hordes of people with no responsibility who create paper work which frustrates those who do have responsibility. A possible solution, he dryly suggested, might be to separate bureaucrats into three classes—one to do the work and two to write letters to each other in crayon.

Education in the USA today is poor, he stated, because incompetent people have taken over control of the schools, because schools are overly burdened with administrators, and because of the soft, progressive approach which has been popular recently. He urged that everyone take a more active part in school affairs, especially in changing curriculums, but warned that it is a slow process and will probably take at least a generation.

The principal speaker of the evening was Secretary of the Army Wilber C. Brucker, who spoke at length on how the Army is spending the tax dollar and ways in which it is cutting out waste and inefficiency.

Exhibitors' Night

The Exhibitors' Night program again proved a rousing success. After an afternoon of visiting the many interesting commercial and technical exhibits, the free snacks and refreshments proved especially welcome. The program included community singing, the crowning of Miss NEMA, Miss AIEE, and Miss EI, and the drawing for the door prizes. First prize, an RCA color TV, was won by George F. Holton, National Vulcanized Fibre Co. Fred Yates, Crown Diamond Paint Co., won the second prize of an RCA Hi-Fi phonograph, and the third prize of a 16 mm movie camera went to Stan Telander, Allis-Chalmers Co.

New Officers for '60 Conference Week of Dec. 5th in Chicago

New officers have been elected for the 1960 conference

which will be held in Chicago the week of December 5th. New Conference General Chairman is William Hoffer, Johns-Manville Corp. A new organizational plan has also been put into effect for the next conference, with two vice chairmen added to assist the general chairman.

Michael Nakonechny, Dow Corning Corp., will be Commercial Vice Chairman. He will be in charge of the committees handling the commercial exhibits, special arrangements, conference newspaper, advertising and collateral materials, and publicity.

Roger White, Glastic Corp., will be Technical Vice Chairman. Committees handling the program, tours, technical publications, and the technical exhibits will report to him.

Committee chairmen chosen to date include: A. E. Bohn, Electro-Technical Products Div., Sun Chemical Corp., Commercial Exhibits; Walter F. Hugger, Electro-Technical Products Div., Sun Chemical Corp., Special Arrangements; and W. H. Bartlett, Johns-Manville Corp., Technical Publications.

Under the new plan the Treasurer and the Chairman of Local Arrangements will also report directly to the Conference General Chairman.

The Challenge to Technical Committees by Vice Admiral H. G. Rickover, U.S.N.

"Nuclear power plants, for many reasons and especially because of the radioactivity hazards that are associated with them, must be designed to have high integrity, i.e. they must be designed and built to good technical standards.

"During the past 10 years I have been personally involved in the designing, building, and operating of nuclear power plants. The high integrity required for these plants has forced us to look very hard and very carefully at existing industrial standards, codes and practices for equipment design, materials, methods of fabrication, inspection techniques, etc., which groups such as yours have established.

"I am sure that you do not expect me to tell you about the few good things I have found. I would like, however, to tell you about the many deficiencies we have uncovered. These deficiencies should be of concern to all of you. In this day of missiles and nuclear power we will not be able to produce in any quantities the equipment so necessary for our national defense unless we establish good standards. For example, I personally know that present inadequate standards, specifications, etc. are hampering the rate at which our Navy is converting to nuclear propulsion.

"Let me be specific and give you some typical examples:

"1. Good welding and good inspection techniques are essential to the building of our nuclear power plants. We have found it necessary to write our own complete standards for welding and weld inspection to remedy the following specific problems encountered in the use of existing standards:

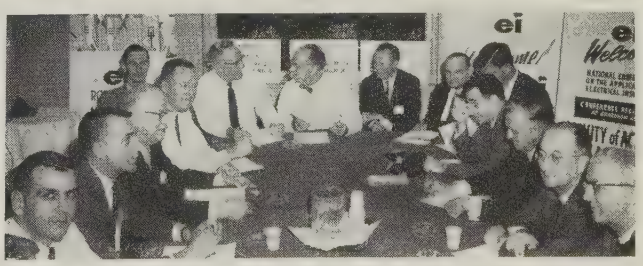
a. The requirements for the type of electrodes and the heat treatment used during welding of stainless steel were inadequate to prevent cracking of such welds.

b. The requirements for radiography of various weld configurations were based on what could readily be achieved rather than on what was necessary to detect harmful defects.

c. There were no requirements as to when inspections of welds should be performed. As a result it was possible for a manufacturer to inspect a weld, find it acceptable, and then damage the weld during subsequent fabrication. There were no requirements for subsequent inspection to prevent these welds from being placed into service.

d. In many cases radiographs taken at a manufacturer's plant and the spot check radiographs taken after delivery of the equipment, both of which were taken in accordance with the same standard, gave different results. In one case,

Technical sessions were all well-attended and provided much new and worth-while information.



Many pre-conference shirt-sleeve sessions of planning committees insured the success of the conference.

Free copies of Insulation *were eagerly snapped up by conference registrants.*

the welds were acceptable; in the other case they were not. This very clearly showed us the inadequacy of the present radiographic standards.

"2. Many industry codes are based on practices that were found to be adequate for equipment to perform satisfactorily under the design conditions which existed many years ago. These conditions of pressure, temperature, etc., were much less stringent than those which materials and equipment are now required to withstand. Our industrial codes have not yet been revised to face these new situations. In some instances the outdated requirements in these codes result in decreasing the reliability of the component. For example, the reinforcement of nozzles for pressure vessels which are subject to high temperatures, and to temperature and pressure cycling, cannot be designed adequately by using the present existing codes; therefore, we have had to write our own special design requirements for such applications.

"3. Another area which I am sure many of you have heard about is the inadequate marking and material identification which prevails in industry. You have heard of the problems we had in the construction of the Nautilus where because of poor marking, ordinary stanchion pipes were used for some of the high pressure systems. Fortunately, this was discovered in time and the piping was replaced. As a result of this incident we have prevailed on industry to use a more positive procedure for identifying various types of pipes. Again in the electrical industry problems of material identification have been experienced. Recently wire markers on some valve position indicators which were supposed to be made of fiberglass insulation turned out to be made of polyvinyl chloride. The temperatures involved in this application resulted in decomposition of the markers with release of chemicals that attacked the wire and insulation with resultant failure of the device.

"4. Since you people are meeting to discuss problems connected with electrical insulation let me give you some examples that are closer to your own work.

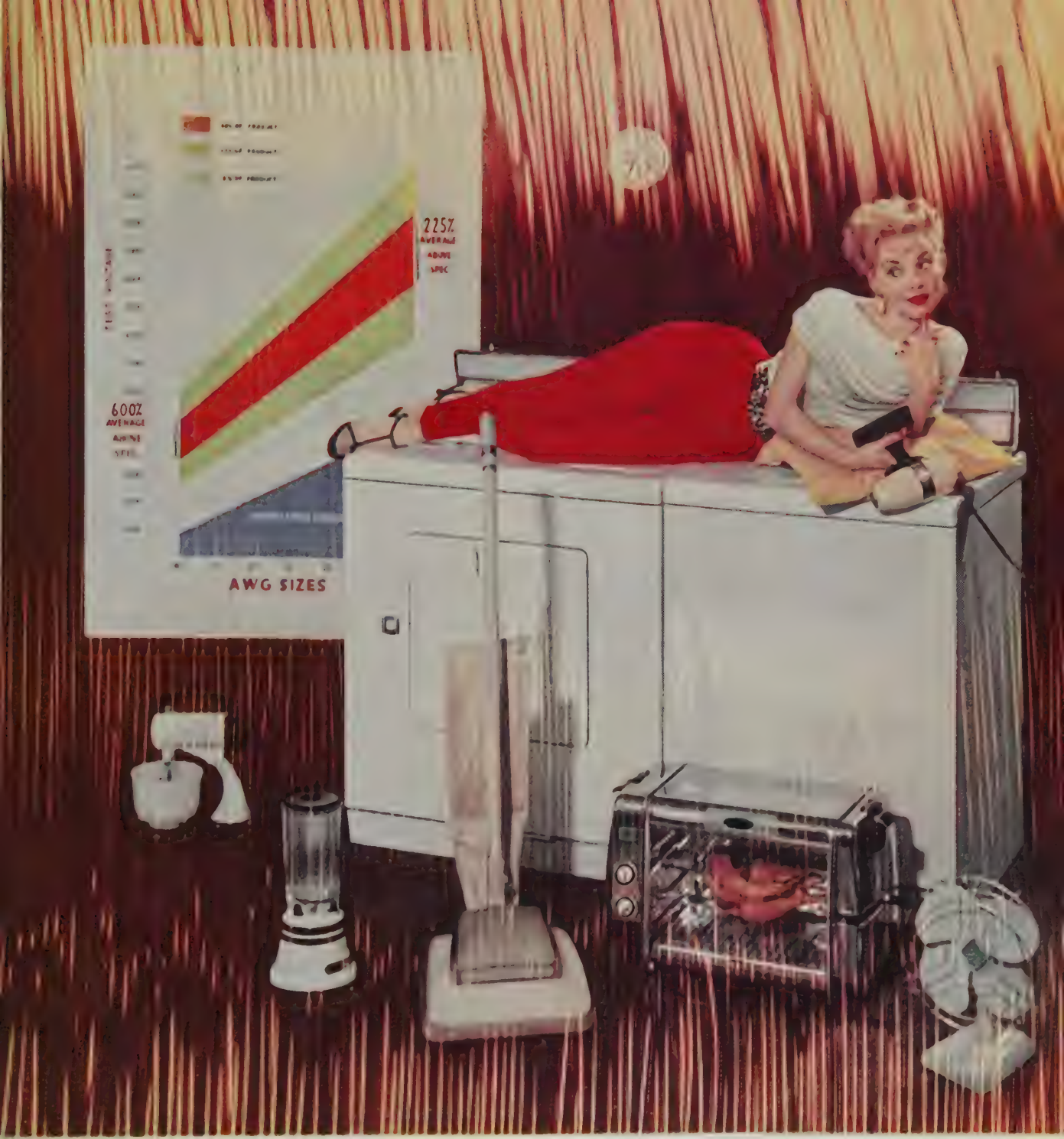
a. In determining the adequacy of materials or equipment, quite often the tests required by the specifications or standards are of a *laboratory* type, which do not represent in any way the actual service conditions the material or equipment has to meet. This tends to give the equipment operator a false sense of security. For example, voltage regulators for ships service turbogenerator sets were subjected to extensive tests lasting over two months at the manufacturer's plant. After installation on the ships, insulation breakdowns were experienced within a matter of hours. From extensive investigation it was determined that the test setup used by the vendor, which was in accordance with specification requirements, did not represent the actual service conditions.

b. Electrical grounds are still one of the problems with which our plants are continually plagued. While part of this problem is caused by poor workmanship, much of the blame must be placed on the electrical insulation not performing its intended function. As a result, we have been forced to reduce the ratings of many insulating materials from those claimed by the manufacturers, which are in turn based on existing standards. For example, we have been trying for many years to get cable for neutron detectors to withstand temperatures of slightly over 200°F. Numerous vendors have claimed that their product will more than do this. However, our tests showed these claims to be unfounded. This again demonstrates the need for adequate standards so that the manufacturers can properly rate the performance of their products.

c. Still another example is that the present standards on insulating materials are such that there can be a large degree of non-uniformity between batches of the same material, with the result that a finished product does not meet its specification requirements. For example, we are faced daily with problems of components such as cables and magnetic amplifiers not meeting insulation resistance requirements.

"I believe that one of the reasons for the present poor standards and specifications is that they are prepared by groups of people who represent the *manufacturers'* viewpoint, rather than the *users'* viewpoint. The manufacturers, when they have to agree on a specification or standard, will invariably agree on one that is the least restrictive to all of them. The user, on the other hand, is generally not sufficiently familiar with the characteristics of the materials to require a better specification or standard. I can therefore only conclude that if we are to improve our standards and specifications the users must become more familiar with the products involved, and insist that the technical committees preparing standards be composed primarily of *users* rather than *manufacturers*. The manufacturers in turn must take on the responsibility to insure that only fully qualified individuals represent them on these committees. Furthermore, these individuals must consider their prime objective to be the preparation of specifications which will produce a high caliber product, rather than agree on mediocre specifications which all interested companies can readily meet."

More conference photos appear on pages 26, 28, and 30.



"A girl has to think about Magnet Wire and specifications and things...."

"...I mean, really! Maybe you think that's too deep for an average housewife like me. But let me ask you, who's got the most to lose if magnet wire doesn't have the proper dielectric strength? Yours truly, that's who! Who suffers if the temperature and abrasion resistance isn't up there? Who but us, with all our appliances?

"I just wish we housewives could pick the magnet wire that goes into the motors and coils of every one of these things. I mean, really! Because I'd pick *Roebling Magnet Wire.* It's always higher than the NEMA Specifications. And if you think that's not important to a girl...!" For data, write Roebling's Electrical Wire Division, Trenton 2, New Jersey.

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Electrical
Insulation

Belden Lead Wire is easy to strip

and solders readily without insulation shrinkage.

maintains its color identification through baking cycles and impregnations.

reduces process inspection.

gives long service life.

Complete stock line of UL voltage and temperature rated wire shown in Catalog L59.

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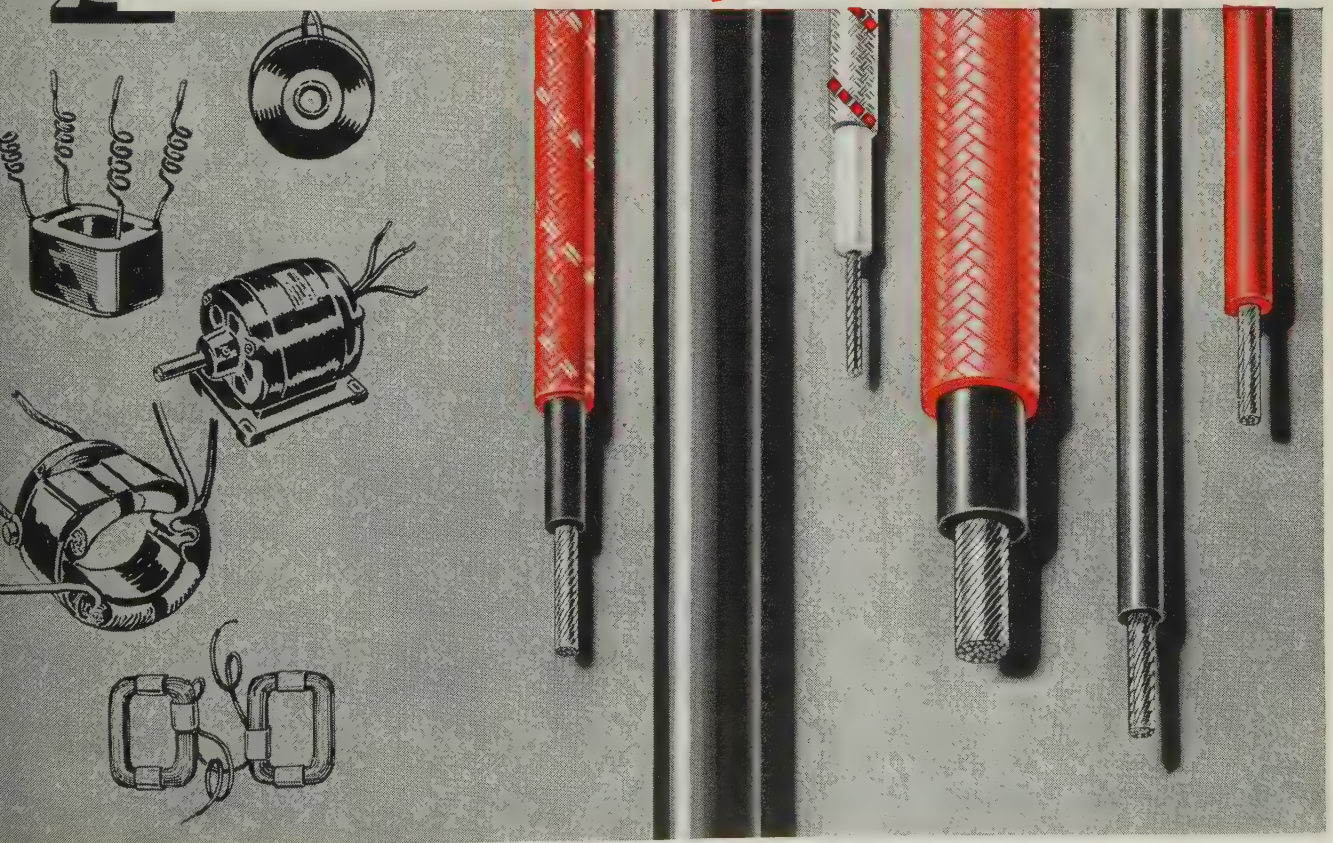
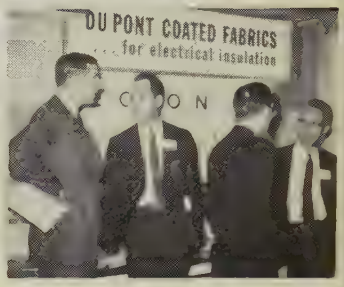



SUFLEX CORPORATION

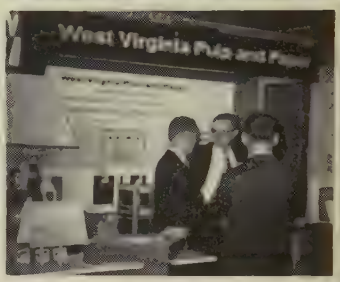





TWO types of TEFLON

DU PONT COATED FABRICS
for electrical insulation

INSULATION

TAYLORITE
ELECTRICAL INSULATI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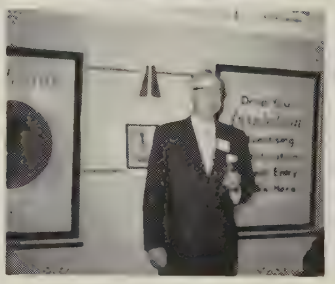
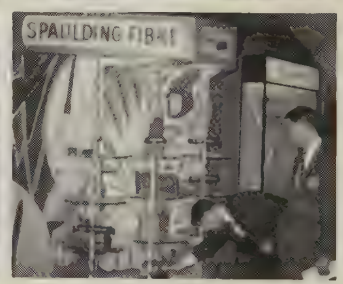
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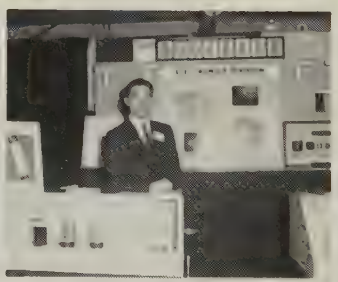



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One way to simplify your design problems

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n today's designs for high-temperature products, this nuch is clear: wide variations in corrosion- and oxidation-esistance plus conductivity make wire selection all-mportant.

You can simplify your design and specification problems by getting a Sylvania recommendation on wire. Sylvania knows wire, knows the particular advantages of each kind. In fact, of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated. Available in a complete range of sizes—.002 to .250, retains optimum characteristics at temperatures up to 1600° F.

Thus you can be sure a Sylvania wire recommendation will be objective—it will be based on your needs, and not limited by what the supplier can supply. Why not get full details and timesaving technical assistance today. Simply write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

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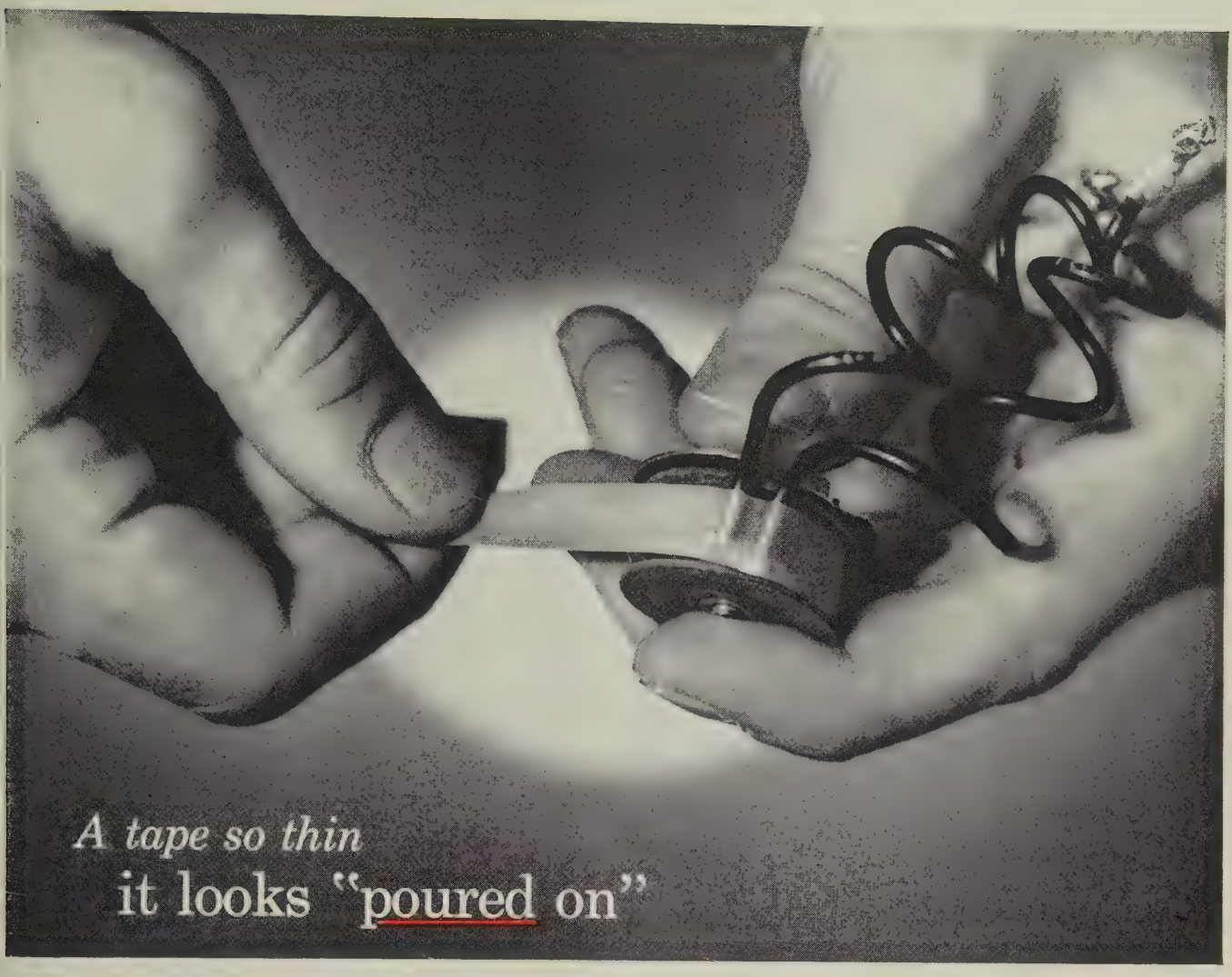

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- *Extraordinary thinness and flexibility*
- *4500-volt dielectric strength per layer*
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Put a layer of J-M Dutch Brand Polyester Electrical Tape on a coil winding, and you'll see every turn of wire stand out, sharp and clear. The one-mil thickness and extra stretch of this unusual tape allow for maximum conformation to irregular surfaces with *minimum tape build-up.*

One of 15 brand-new tapes for the electrical "specialist," Johns-Manville Dutch Brand Polyester Tape is ideal for Class B insulation in electric motors. Its dielectric value is 4500 volts. It stays stable at operating temperatures up to 125°C . . . resists oil, grease, corrosive chemicals, solvents, punctures, tears, and moisture. Available with a thermosetting adhesive that won't throw out at high speeds, or with a pressure-sensitive adhesive that holds instantly and never becomes brittle.

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Pixilated Patents

By Mike Rivise

(Thirty-seventh in a series of odd and interesting inventions in the electri-onics field from the files of the U. S. Patent Office.)

Answering the call of nature where they please is a prerogative zealously maintained by dogs . . . and exercised by them in defiance of every stratagem devised by man.

Some time ago the city fathers of New York installed sand boxes on one of that city's most fashionable avenues. Every effort was made to make the boxes appealing to the snobbish canines who frequented the area. Yet an eye-witness account by a well-known reporter stated that during the first day not a single box was used for the purpose for which it was intended. The smart set simply would not bend a leg to anything as common as a sand box.

The failure of this soft, modern approach in the attempt to alter the customs of dogs serves to point up the extreme difficulty of the problem. In contrast to this emphasis of the positive, an earlier attempt utilized the forces of electricity in a more negative approach, but with as little success.

On May 25, 1909, Aden H. Roberts was granted patent No. 922,956 on his "new and useful device for preventing dog nuisance." It consisted of electrified plates to be placed in those areas customarily visited by dogs. The unfortunate creature's answer to the call of nature would then ground the current and give the dog a "severe shock the instant the stream of urine strikes the plate." The patent modestly states that "After receiving one such shock it is believed that that particular locality will be shunned in the future by every dog so punished."

In the drawings figure 1 represents a side elevation of the device; figures 2 and 3, vertical and horizontal transverse sections, respectively; and figure 4, a detail on an enlarged scale. According to the patent description, the device consists of a plate (A) of metal or other electrifiable material supported in a frame or standard (B) which rises from a suitable base. At each end of the plate, pins (C) which may be bent into shape from a single metal rod and fastened along the edge of the plate, project into socket pieces (D) of insulating material fitted into holes bored in the uprights of the frame. These pins and sockets will preferably be inclined upward from the plate in order that rain and moisture collecting on the plate cannot drain off to the uprights and thereby short-circuit the plate. A wire conductor (E) leads to the plate from a socket (F) to which a wire from a source of electricity may be attached. The plate, when coupled to an electric light circuit or to a battery or other source of electric current of suitable power, becomes a terminal from which no current will pass until a ground connection is made. Bars (G) are provided to protect passers from contact with the plate. A wire netting or ornamental grille may be used in place of the bars, or advertising cards may be attached to them.

Due to lack of any report from a competent market research firm, we are not prepared to state how effective this may have been in advertising to dogs. However, based on observations made during our short walks to and from the office, we can state that this device has not been exceptionally effective in inhibiting this particular behavior pattern of man's best friend. It seems only reasonable to conclude that the consternation caused by one such encounter would lead any dog thereafter to return only to the familiar spots proven satisfactory through long usage, resolved never to break with tradition again.

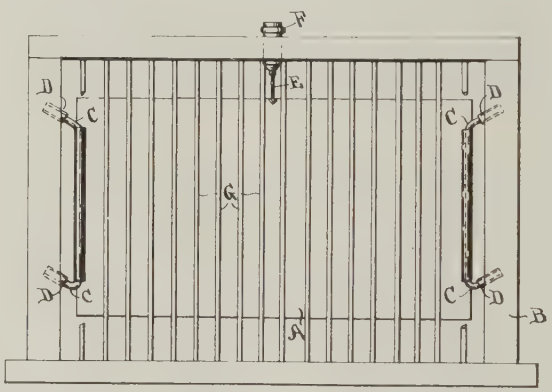

Fig. 1.

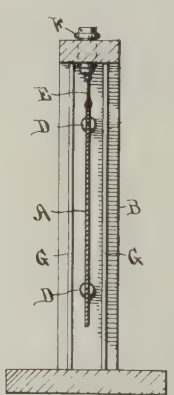

Fig. 2

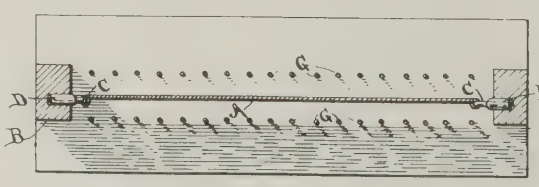

Fig. 3.

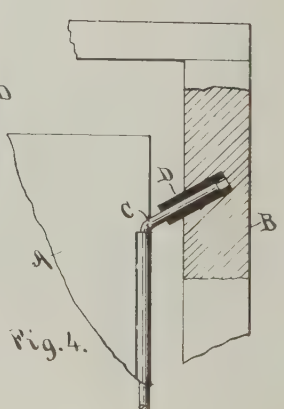

Fig. 4.

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getting good reception
in community TV...

Mohawk's H-F coaxials, jacketed and insulated with TENITE POLYETHYLENE

For community television distributing systems in any area, Mohawk H-F coaxials do a complete transmission job, from tower or relay station right into the living room.

Tenite Polyethylene is used as jacketing and insulating material on these cables. It offers all-round high performance which gives them long life, keeps line loss low, and permits ease in installation.

As a jacketing material, tough Tenite Polyethylene provides excellent resistance to abrasion, weathering, moisture, and heat. Users can look forward to years of maximum protection.

As an insulating material, Tenite Polyethylene has a low power factor, which holds energy losses to a minimum. In these Mohawk cables, both solid and foamed Tenite Polyethylene are used for primary insulation... the foamed material having an even lower dielectric constant than the solid, thus making possible a thinner insulation with a resulting decrease in cable weight.

Linemen find that cable jacketed with lightweight Tenite Polyethylene is easy to handle and strip and is flexible even at sub-zero temperatures.

There is a formulation of Tenite Polyethylene to meet the demands of most insulating and jacketing applications. For further information on this useful plastic, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

- *Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers as unique spherical pellets which flow freely in the extrusion process and in "air-veying" bulk shipments from truck to bin.*
- *Cable manufactured by Mohawk Wire & Cable Corporation, 320 River Street, Fitchburg, Massachusetts. Jacketing and insulation extruded of Tenite Polyethylene.*

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POLYETHYLENE
an Eastman plastic

WITH A VIEW TO THE FUTURE...

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The tubing with a memory

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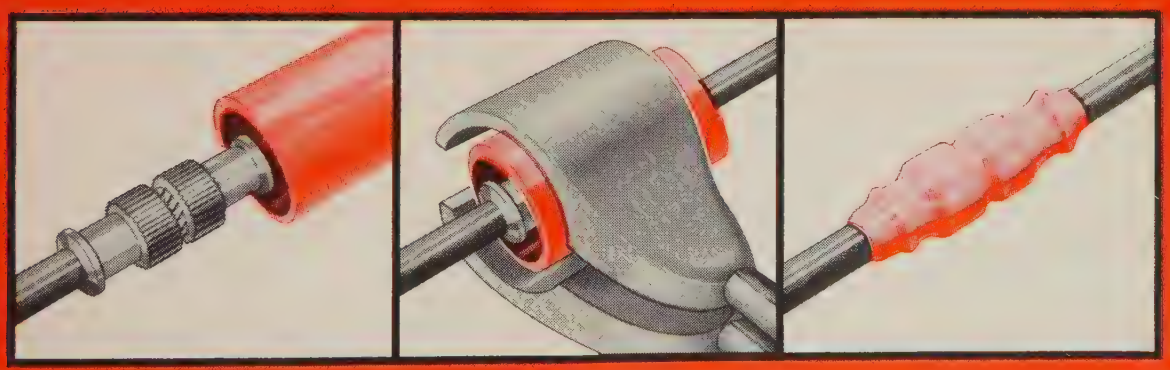
MISSILE AGE HOOKUP WIRE, COAXIAL CABLE AND INSULATION FOR DIFFICULT ENVIRONMENTS

AN ENTIRELY NEW SERIES OF HEAT-SHRINKABLE TUBINGS FOR BOTH PRODUCTION LINE AND FIELD WORK, PRE- OR POST-INSULATION, FEATURING FAST, EFFICIENT FABRICATION AND LONG LIFE UNDER SEVERE CONDITIONS.



Slip Thermofit on — Heat it — It shrinks

3 SECONDS

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Index to Insulation's 1959 Editorial Articles

Listed below are the titles of the major articles that appeared in *Insulation* from January 1959 through December 1959. They are grouped according to broad classifications. Although an article is listed under the most logical heading as determined by its subject matter, it may also contain information relative to other subject headings. Articles appearing in two regular departments of *Insulation* have been indexed for easier reference: Insulation Forum and Pixilated Patents.

Other regular departments appearing in *Insulation* but which have not been indexed include: Association News, Dates to Circle, From the Editor, Industry News, NEMA Electrical Insulation Index, New Literature, New Products, New Publications, News and Views, and People in the News.

Headquarters for
INSULATION TESTING

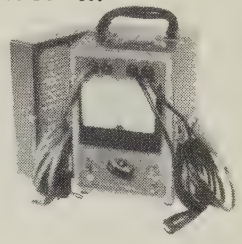
High Voltage Breakdown
Leakage Current Measurement
of Assemblies, Components and Materials

HYPOT® High Potential Test Sets provide accurate, direct-reading measurement of insulation leakage current for over-potential tests to applicable commercial and military specifications.
Available are models supplying test potentials to 150 kv and higher. Optional features include automatic control for rate of test voltage rise, automatic test cycling and provisions to meet every application.

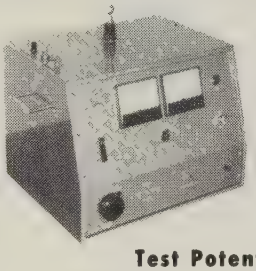
10 kv Insulation Testing . . Portable HYPOT® Jr.

Insulation testing at a-c potentials with separate indication of leakage current and insulation breakdown. Optional features including audible "squawker" leakage current indicator with provision for external control circuits, meet needs of high production and automated test installations.

Model 404 HYPOT® Jr. is designed for insulation testing of components, assemblies, and cables. Output variable 0 to 4000 v a-c, read on 4½" meter. Leakage limit light adjustable from 0.3 to 3.0 ma. Arcing and corona signalled by separate indicator lights. Operates from 110-120 v, 50/60 c outlet. Measures 6" x 9" x 8½". Weight is 20 lbs. Net, complete $150.00



Insulation Leakage .02 mma to 10 ma . . Potentials to 30 kv



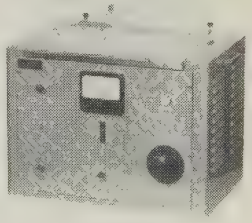
Bench HYPOT® Test Sets, a-c and d-c models, have outputs to 30 kv. Separate 4½" meters for test voltage and leakage current. Wide selection of models to meet specific applications.
Model 424 Bench HYPOT® provides 0-5000 v d-c. For testing cables, condensers, coils, transformers, motors and complete assemblies. Measures leakage current from 0.1 microampere to 100 microamperes over four scale ranges. Rapid testing of capacitors with output of 5 milliamperes under short circuit. Operates from 110-120 v 50 60 c outlet with long-life selenium high voltage supply. Net complete $497.50

Test Potentials 150 kv and up

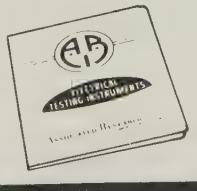
Mobile HYPOT® Test Sets offer potentials to 150 kv and higher. Power source and metering circuits in a single, mobile cabinet. Write for new HYPOT® Catalog.

Insulation Materials Tester . . . ASTM Specs. Fixtures for Tape, Film, Liquids and Solids

Dielectric strength of materials determined to laboratory accuracy . . . yet speed and simplified operation meet needs for production and quality control applications. Transparent test cage with safety interlocks is optional as well as automatic rate of rise control. Interchangeable fixtures available for varnishes, porcelain, oils, solid filling compounds, paper, tape, acetate sheets, films, tubing and cloth. Prices start at $1175.00. Write for bulletin describing the Model 4501 HYPOT® Materials Tester.



NEW! Complete Catalog



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Association News

Watts Elected President Of Mica Association

Frank F. Watts, Gillespie-Rogers-Pyatt Co., has been elected president of the Mica Industry Association Inc. Other new officers are Robert J. St. Peter, Western Hemisphere Raw Materials Corp., first vice president, and Peter Yanello, Reliance Mica Co., second vice president.

Discuss Effects of Radiation On Insulation at AIEE Meeting

A round table discussion, one technical session, and two symposium sessions on the effects of radiation on electrical/electronic insulation are being scheduled for the American Institute of Electrical Engineers' general meeting in the Hotel Statler, New York City, January 31-February 5. They are being jointly sponsored by the Electrical Insulation and Nucleonics Committees. The Subcommittee on Effects of Radiation on Insulation and the Radiation Technology Subcommittee of the Nucleonics Committee will also hold a joint meeting.

Seminar on Standardization

Dr. John Gaillard will hold a five-day seminar on industrial standardization in the Engineering Societies Building, New York City, January 25-29. For details and registration write to Dr. John Gaillard, 135 Old Palisade Road, Fort Lee, N.J.

SPE Meets in Chicago, Jan. 12-15

The Society of Plastics Engineers will hold its Sixteenth Annual Technical Conference at the Conrad Hilton Hotel, Chicago, January 12-15. There will be 23 technical sessions, including one on electrical insulation, composed of three or four technical papers each. The Professional Activities Group on Plastics in Electrical Insulation will hold an open meeting, as will other PAGs.

New national officers will be installed during the meeting. They are George W. Martin, Holyoke Plastics Co., president; Frank W. Reynolds, IBM Corp., first vice president; Haiman S. Nathan, Atlas Plastics Inc., second vice president; James R. Lampman, General Electric Co., secretary; and Joseph B. Schmitt, Koppers Co. Inc., treasurer.

Registration fees are $15 for SPE members, $30 for nonmembers, and $5 for students. For advance registration contact the SPE, 65 Prospect St., Stamford, Conn.

Change Site of Military Electronics Convention

The 1960 Winter Convention on Military Electronics will be held at the Biltmore Hotel, Los Angeles, February 2-5, instead of at the Ambassador Hotel as previously announced. The convention is sponsored by the Professional Group on Military Electronics, Institute of Radio Engineers. About 4,000 industry executives, engineers, scientists, and military leaders are expected to attend.

Electronic Packaging Symposium

The latest advancements in the packaging of electronic equipment will be spotlighted at an Electronic Packaging Symposium at the University of Colorado, Boulder, Colo., August 18-19. One of the highlights will be a discussion of electronic packaging for outer space. For further information write to the Bureau of Continuation Education, 352 Chemistry Building, University of Colorado, Boulder, Colo.

International Plastics Meeting

The 1960 International Plastics Exhibition "macroPlastic" will be held in Holland, October 19-26. It had previously been announced that the show would be held on October 12-19.

A World Congress on the Technology of Plastics Processing will precede the exhibition. The Congress is sponsored by the Association for the Advancement of the Knowledge of Materials, the Royal Institute of Engineers and the Royal Netherlands Chemical Federation.

Further details may be obtained from N.V.'t Raedthuys, Tesselschadestraat 5, Amsterdam, Holland.

Report on Printed Circuit Sales And "Make or Buy" Trend

Users of printed circuits are buyi an increasing percentage of the v ume they use according to a rece survey by the Institute of Print Circuits. Because the report was bas on a limited random sample (que tionaires were returned by 9 man facturers who produce printed cuits for sale to others and by users of printed circuits), only t trends are considered reliable. T reports from the users indicated t following:

Year	% Volume Make	% Volum Buy
1958	21%	79%
1959	17%	83%
1960 (est.)	13%	87%

Nine companies reported the val of printed circuits used in 1958 w $363,500, 12 companies said usa value was $853,000 in 1959, and (not the same 9 who reported usa in 1958) estimated usage value f 1960 to be $1,159,500.

National Electrical Week, Feb. 7-13

The theme of next year's Nation Electric Week, to be observed Febr ary 7 through 13, will be "Electrici Sparks the '60s." The event is spo sored each year during the week February 11, the birthday of Thom Alva Edison, by the electrical indu try's leading trade associations.

NRC 1960 Insulation Meeting In Washington, New Officers Elected

The 1960 Conference on Electric Insulation will be held at the Ma flower Hotel, Washington, D.C., Oct ber 17-19. The conference is spo sored by the National Academy Sciences-National Research Counc

New officers elected at the rece meeting in Pocono Manor are W M. McMahon, Bell Telephone Labor tories Inc., chairman; S. I. Reynol General Electric Co., vice chairma and Philip Franklin, Diamond Or nance Fuse Laboratory, secretary.

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Epoxy "Fluidized Bed" Process For Insulating Motors

Sixty-five per cent of the labor of winding electric motors and the entire cost of slot liners, end fibres, and other insulations are savings claimed by Gebe Electronic Services Inc., Los Angeles, through the use of the "fluidized bed" coating process to apply epoxy resin.

Starting with loose laminations, Gebe bonds them into stacks containing the necessary laminations. The finished stacks are masked with glass cloth electrical tape,* hung on racks, and placed in an oven.

When the parts have reached approximately 375°F, depending upon the size of the part and the desired thickness of the resin coating, they are ready for dipping. Instead of a conventional dip tank, however, an aerated bed of powdered epoxy resin is used. This bed consists of an upper and a lower chamber, divided by a porous membrane. Compressed air is fed into the lower chamber and the upper chamber is filled to the required depth with the powdered epoxy. Passing through the membrane, the air bubbles up through the powder,** giving it the characteristics of a slowly simmering liquid.

Pre-heated parts are lowered into the bubbling powder for from one to two seconds, again depending upon the size of the unit and the thickness of coating wanted. The heat contained in the part causes the tiny particles of resin around it to melt and adhere to the metal surfaces, building up an even coating of resin. As the heat in the dipped part begins to dissipate, unmelted particles of resin cling to the surface of the coating, giving it a granular appearance.

The dipped parts are then moved on their racks to the oven where they are baked for from 20 to 30 minutes at about 375°F. This baking period "flows out" the granular resin on the surface into a smooth, shiny exterior and cures the resin. When the parts have been removed from the oven and allowed to cool, the masking tape is stripped away and the end surfaces ground on abrasive belts to specified dimensions.

The laminations then have a 7-mil coat of resin extending uniformly from the center of the slot over the edge of the outside lamination to eliminate edge shorting.

Tests by Gebe customers on wound stators and armatures reportedly show a rejection rate of less than one-tenth that expected with conventionally insulated slots.

Gebe is currently coating lamination stacks up to 4½ inches long by 3 inches in diameter and is installing new equipment to handle larger jobs.

**"Scotch" brand No. 27*

***"Scotchcast" brand No. XR-5005*

All photos are courtesy Minnesota Mining and Mfg. Co.

Figure 1, stacked laminations a shown at the left, the required numb of laminations counted and ready f insulation. The outside edge of t stack is masked with glass cloth ta (center) to take the oven temperatur and wire is twisted around the ma to form a convenient handle. The s tor at the right has been heated 375°F and dipped into an aerated b of powdered resin. After the maski is stripped off, the outside edges ground on abrasive belts.

Figure 2, the masked stator is dipp into the gently bubbling resin in t aerated bed where the heat of t stator causes the resin surrounding to melt and stick to the stator. T build-up of resin is controlled by t temperature of the stator and t duration of the dip. A final bake then used to impart a smooth fini to the resin.

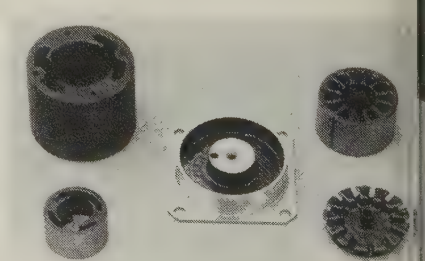
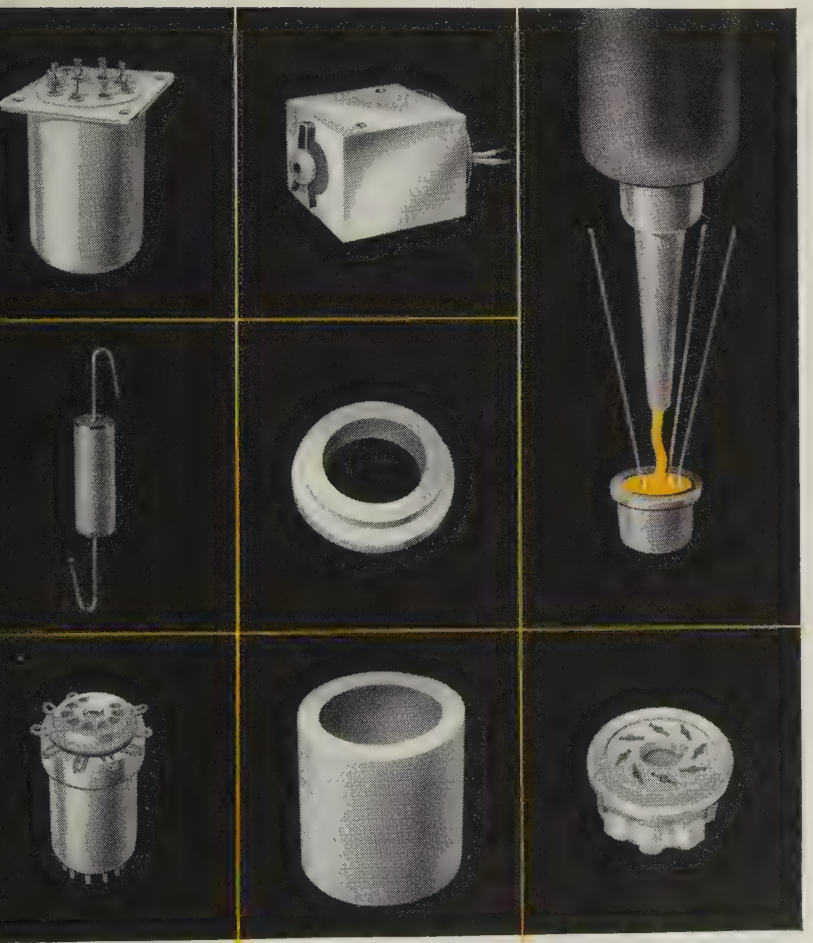


Figure 3, finished parts show th nearly any contour can be coat with powdered resin.

Widen the scope of component design

...with ALUNDUM* high-purity fused alumina grain



Here is a super-refined, highly versatile ceramic grain that gives electronic component designers real creative latitude. With its superior electrical and mechanical properties to work with, even the most advanced design concepts can be translated into practical products efficiently and economically.

Electrochemically refined to extreme purity, the outstanding performance of this Norton ALUNDUM Grain in 500 and 900 mesh size, has long made it a favorite for coating the heaters of radio and television tubes. It's readily available for use throughout the electronics industry — not only in the above mesh sizes but also in a large range of coarser sizes — for virtually limitless applications.

For example, ALUNDUM grain combined with epoxy resins or silicone compounds makes possible superior potting, encapsulating, and sealing agents. Again, used as a basic ingredient in ceramic type mixes or in insulating powders, it readily lends itself to casting, molding or extruding of sleeves, shells, tubes, collars, etc. And in every case, it makes design easier . . . processing more profitable.

Check the exceptional characteristics of ALUNDUM Fused Alumina Grain in the table below. Then get in touch with a Norton Engineer for specific details on your precise requirements. He'll be glad to describe the application of this and other types of Norton Refractory Grain to electronic component design. Write to NORTON COMPANY, Refractories Division, 580 New Bond St., Worcester 6, Mass.

ALUNDUM Fused Alumina Grain Gives You these Superior Properties *. . . and many more!*

High Dielectric Strength

High Electrical Resistance

High Heat Conductivity

High Resistance to Thermal Shock

High Mechanical Strength

High Dimensional Stability

Extreme Hardness

Excellent Abrasion Resistance

Available in a wide range of grain sizes

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New Products

For further information on these products, print the item number on the Reader Service Inquiry Card in this issue. Fill out and mail card—no postage required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

High Intensity X-Ray Generator

Model 60-50-FW1P X-ray generator produces high intensity, soft X rays for environmental or other studies requiring radiation in the range from 5 to 50 kv at intensities ranging to the order of 10^6 R/min. Water cooling of the X-ray tube and transformer unit permits continuous operation at maximum rating of 50 kv at 50 ma. The X-ray tube features a low absorption beryllium window and is available in a variety of target materials. The Bracke-Seib X-Ray Co. Inc., 16 Pelham Bay Park West, Pelham Manor, N.Y.

Print No. Ins. 100 on Reader Service Card

Shock-Resistant Epoxy Compound

A new shock-resistant epoxy casting system, "Hysol" 6622, is designed for embedding electric motor stators and transformers, casting or potting of large masses where exotherms cannot be tolerated, and for potting circuits and transformers having strain-sensitive elements. Hysol 6622-105 (filled) reportedly has successfully passed the requirements of MIL-T-27A, offering excellent resistance to thermal and mechanical shock through its flexibility. Castings containing large steel inserts of various configurations have been cycled between —65°C and 150°C without cracking. It has a pot life of several days at room temperature and simplified curing characteristics. Free product bulletin. Houghton Laboratories Inc., Olean, N.Y.

Print No. Ins. 101 on Reader Service Card

Silicone Rubber Wire Insulation

Two new types of low shrink silicone rubber stock for cable and wire insulation have been announced. The first is "Union Carbide" K-1347 silicone rubber compound, reported to be a premium grade material with superior physical and electrical properties for high quality wire and cable insulation under exposure to extreme hot and cold temperatures. It is designed for use on wire to meet military and industry specifications. It can be continuously vulcanized on conventional equipment, with either steam or hot air. The second is "Union Carbide" K-1357 silicone rubber compound, which is available in coiled strips for direct feed to the extruder. It can be cured in either steam or hot air and is said to give excellent electrical and physical properties at moderate cost. Silicones Div., Union Carbide Corp., 30 East 42nd St., New York 17.

Print No. Ins. 102 on Reader Service Card

Urethane Foam Kit

A compact, virtually fool-proof, do-it-yourself kit for mixing urethane foam contains pre-mixed chemical components capable of creating lightweight rigid urethane foam to fill areas as small as a cubic foot. "Plus" factors of urethane foam reported include strength, light weight, resistance to the elements, and excellent thermal and electrical insulating qualities. A sealed can containing a pre-measured chemical serves as the mixing container. The user merely combines and stirs the components in accordance with printed instructions prior to pouring into the mold or void. The material expands to 30 times its original volume within 10 minutes. The resulting lightweight rigid foam is said to cling to any surface. The Dayton Rubber Co., 10 Rubber St., Dayton 1, Ohio.

Print No. Ins. 103 on Reader Service Card

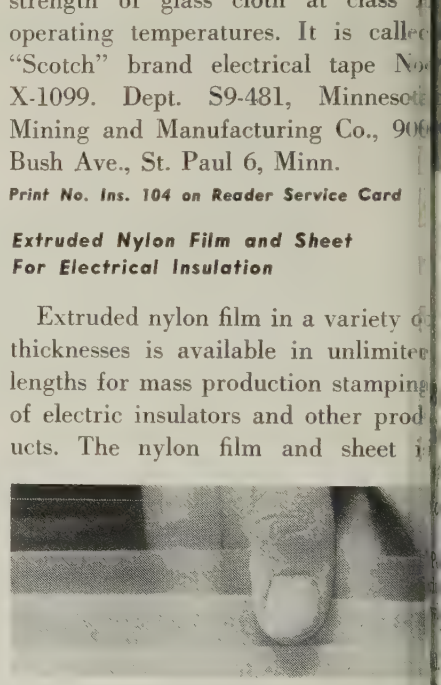
Flexible Epoxy Resin Class F Pressure-Sensitive Tape

A new electrical tape—described as the first pressure-sensitive, fully cured flexible epoxy tape on the market—has a backing of fully-cured flexible, 100% solids epoxy resin reinforced with a .002″ glass cloth. Because of its high resistance to cold flow, good conformability, high electric strength, and good physical properties, the new tape is recommended for applications which require the electric strength of a continuous film of epoxy resin and the physical strength of glass cloth at class F operating temperatures. It is called "Scotch" brand electrical tape No. X-1099. Dept. S9-481, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 104 on Reader Service Card

Extruded Nylon Film and Sheet For Electrical Insulation

Extruded nylon film in a variety of thicknesses is available in unlimited lengths for mass production stamping of electric insulators and other products. The nylon film and sheet is



offered in thicknesses from .002″ to .060″ and in widths up to 18″. The material is grease, abrasion, and vapor resistant, has a low coefficient of friction, and a low permeability factor. U. S. Gasket Co., Camden 1, N.J.

Print No. Ins. 105 on Reader Service Card

Steatite Ceramic for Small Parts

"Lavolain" is a steatite ceramic designed for the production of relatively small parts requiring high dielectric strength combined with good mechanical strength and thermal shock resistance. Its high dielectric

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	230	105	87.4
4	155	170	163	143	73.3	53.3
6	103	115	108	91.5	51.5	35.0
Solid						
2	239	260	232	219	92.2	79.2
4	151	164	152	136	64.0	48.0
6	100	112	101	87	45.7	31.7

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

cause it's the lightest, polyethylene-covered e wire is the easiest for linemen to string . . . hardest for ice and snow loading, gale- ce winds to bring down.

yethylene-covered line wire, depending on size and con- tor, weighs from 5% to 32% less than other types. That's at the figures in the specifications tabulated above show. his, of course, is no news to linemen who have strung types of weatherproof line wire. They may not be able quote pounds and percentages, but they all know you 't beat polyethylene on weight.

Linemen's Favorite Material

ht weight means easy handling, one of the main reasons yethylene rates tops with installation crews. They also polyethylene wire because it's clean...free-stripping... a smooth, self-lubricating surface that almost makes ing a pleasure. And despite the exterior slip, the plastic ering hugs the conductor tightly, doesn't ruffle as it goes r crossarms.

"Built-in" Safety Factor

yethylene's lightness provides lasting mechanical advan- es, since span loads don't tax supports as much as heavier e wire. This "built-in" weight safety factor pays off when ent storms push aerial construction to strain limits... en ice and snow loads topple heavier lines.

n added factor in polyethylene wire's ability to stay up er adverse conditions is its smaller diameter. It offers resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous...tough...resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene...The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

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Branches in principal cities

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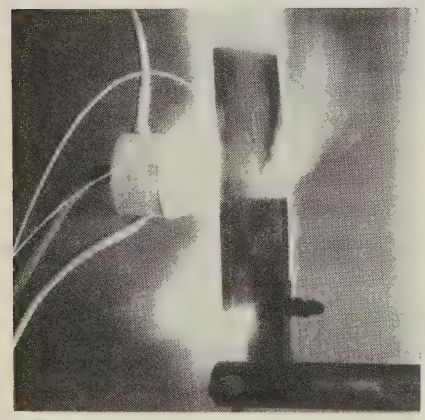
strength at elevated temperatures reportedly makes it desirable for small rods, bushings, resistance-wire holders, and switch bases for use in electric ovens, roasters, toasters, and immersion heaters. It is available in a wide selection of colors. Ball and socket insulating bushings made of Lavolain offer high temperature insulation when flexibility is required. The Star Porcelain Co., Muirhead Ave., Trenton 9, N.J.

Print No. Ins. 106 on Reader Service Card

New Ultra-High Temperature Resistant Laminate for Missiles

A new grade of "Dilecto" laminated plastic is designed for use in missiles and for other applications that require exceptional heat resistance. It is made by impregnating graphite fabric with a heat-resistant phenolic resin. Still classified as a development item, the lab designation is N-104-84-



2. Sample quantities are available to companies that have a "DX-A2" ballistic missile program priority. In laboratory ablation tests, a 6″ square by ¼″ thick sample was exposed to a 5000°F flame. It required more than 10 min to burn through the sample, giving it a burn-through rate of less than 0.0005-in/sec. Continental-Diamond Fibre Corp., Newark, Del.

Print No. Ins. 107 on Reader Service Card

Silicone Impregnating Varnish Cures at 150°C

SR-220, a new low-temperature curing silicone impregnating varnish which is said to develop outstanding electrical properties at 150°C, also is reported to offer superior heat life and excellent shelf life and tank stability for manufacturers of transformers and electronic equipment. By applying a coating of SR-220 over existing organic insulation systems, it reportedly is possible to obtain improved temperature and heat life capabilities. Thermal endurance of SR-220 is far superior to conventional silicone impregnating varnishes on dielectric strength versus heat aging at 250°C (ASTM-D-1346, glass tape method). Due to a unique formulation and catalyst system, excellent shelf life and tank stability are claimed to be available in SR-220 low-temperature curing varnish. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 108 on Reader Service Card

Flame-Retardant Cellulose Base Fiber Insulation

New "Duroid" 225FR is a flame-retardant version of a cellulose base fiber insulating material that does not appreciably differ from the original grade in dielectric and mechanical strength. The new grade extinguishes itself in less than the five seconds specified by the Underwriters Laboratories' vertical test qualifying flame-retardant materials. Dielectric strengths up to 350 vpm (bone dry) and 200 vpm at 7% MC, and arc resistance of 75-100 seconds are claimed. Tensile strength, lengthwise, is 17,000 psi and crosswise, 6,000 psi; bursting strength is 1,800 psi. Deep mahogany in color, Duroid 225FR is available in standard thicknesses of .031″, .062″, .093″ and .125″. It is one of the most formable materials in the Duroid line. Rogers Corp., Rogers, Conn.

Print No. Ins. 109 on Reader Service Card

Heat-Reactive Vinyl Insulation Tubing in 25 Sizes

"ScotchTite" heat-reactive vinyl tubing, which contracts at temperatures over 275°F to form skin-tight electrical insulating "armor" for symmetrical rods, tubes, or contoured shapes, is now available in 25 standard sizes to cover objects 5/64″ to 5″ in diameter. The product reportedly shrinks under heat up to 30% in diameter and 15% in length in 4 to 8 minutes at 300°F. It is applied by placing it over the object to be covered and suspending it in any heated chamber. Abrasion and chemical re sistant, the tubing is UL recognize as electrical insulating material. A fe of the applications include insulatio and protection of harness cables, con densers, coils, ground straps, bus bars large transformer leads, tool handles high voltage leads, antennas, and flex ible conduit. Free brochure. Dep E9-480, Minnesota Mining and Manu facturing Co., 900 Bush Ave., St. Pau 6, Minn.

Print No. Ins. 110 on Reader Service Card

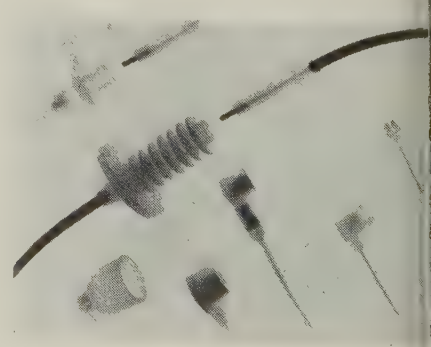
Vinyl Coating with Insulation Properties

Quelcor vinyl coating reported has exceptional dielectric properties making it an excellent electrical insu lator. Also, surfaces subject to chem cal attack and weathering are said t be easily made durable and econom cal to maintain with the spray coatin based on "Bakelite" brand vinyl resi Vinyl resin-based coatings resist mo petroleum fractions, gasoline, grease acids, and solvents. Applied to a su face that is clean, dry, and free c scale, the coating, formulated with built-in primer, dries to a tough durable film which improves appear ance. It forms a smooth film—touch dry in as little time as one hour—tha adheres tightly to many porous an non-porous surfaces. Quelcor Inc Front and Broomall Sts., Chester, Pa

Print No. Ins. 111 on Reader Service Card

Flame-Retardant Polyethylene Electrical Connectors and Tube Caps

A complete range of high voltag electrical connectors and tube ca connectors are now available in flame retardant "Grex" high density poly ethylene. The material is said to mak possible use of the connectors in ap plications previously prohibited b Underwriters Laboratories Inc. Th rigid connectors reportedly withstan higher temperatures and resist fir



n arcing. The tube cap connectors complete integrally molded as-blies with wire insulation carefully cted to meet rigid operating and ronmental specifications. Alden ducts Co., 117 N. Main St., Brock-Mass.

No. Ins. 112 on Reader Service Card

l Boards for Printed Circuits

lectronic designers can make, and ake, their own high quality printed uit layouts—without leaving their —with a new "Fotoceram" grid rd. It is clad on both sides with per that can be etched away as red. The grid for installation of nponents consists of .052" round s spaced 0.1" apart on center. No cial equipment is needed to use the rd. In using the grid board, a de-ler first covers the area he wants use for circuitry with an etching st. Then he uses hydrochloric acid ammonium persulfate for remov-excess copper. Copper that re-ns makes up the desired layout. ough-hole plating is said to be un-elled, and components can be dered to the board more than 50 es without circuit run failure. The s-ceramic board reportedly has n strength, high temperature re-ance, zero water absorption, and non-flammable and dimensionally ble. Detailed specifications avail-e in Bulletin CD9.01. Electronic nponents Dept., Corning Glass rks, Bradford, Pa.

No. Ins. 113 on Reader Service Card

e and Cable Insulated with y FEP "Teflon" 100

A new material for jacketing multi-ductor and coaxial cables and for nary insulation on hook-up wires, P Teflon 100 is a melt extrudable npound that permits the production high temperature wires and cables ong, continuous lengths. Its oper-ng temperature is said to extend to +200°C. Primary insulations the cables can be TFE Teflon, sili-e rubber, or FEP Teflon 100. The terial reportedly has all of the ex-ent characteristics of the widely d TFE Teflon. The same range of ulation thicknesses will provide the he voltage ratings. It is a clear ma-al that can be pigmented and

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Char Test favors

MOSINEE Flame-Resistant Papers

- Mosinee flame-resistant papers consistently test less than the minimum requirements of 4½" char when subjected to U.S. government specification test methods.
- Special flame-resistant process, developed by Mosinee laboratories, can be applied to many of our papers.
- Ideal for paint arrestors, furnace filters, insulation, drop cloths, covers for stored goods, and packing and wrapping papers.
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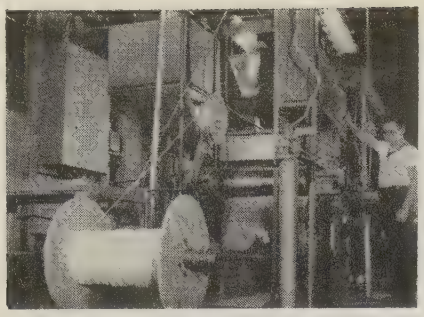
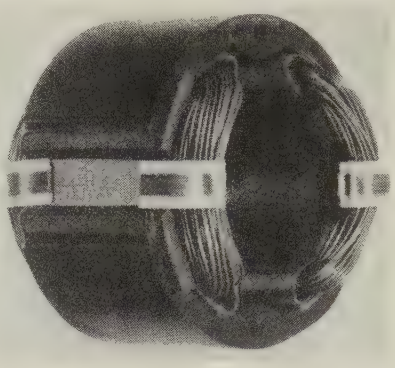


striped for identification purposes. American Super-Temperature Wires Inc., West Canal St., Winooski, Vt.

Print No. Ins. 114 on Reader Service Card

Machine Formable Insulation For Coil Retainer Stock

"Perma-Form" machine formable insulation is used primarily as coil retainer stock, particularly in "universal" type, fractional horsepower motors. It is a combination of .005" rag paper and .002" "Mylar" bonded to #3 temper, #4 edge round, .032" x ¼" flat rolled wire. With Mylar as the prime surface, the Mylar-rag laminate has an average dielectric strength of 1400 vpm. The adhesive (approx. 1 mil used) has an average dielectric strength of 500 vpm. Perma-Form is packed on reels. Because of its continuous length, simple cut-off and forming setups are said to produce permanently formed parts at high

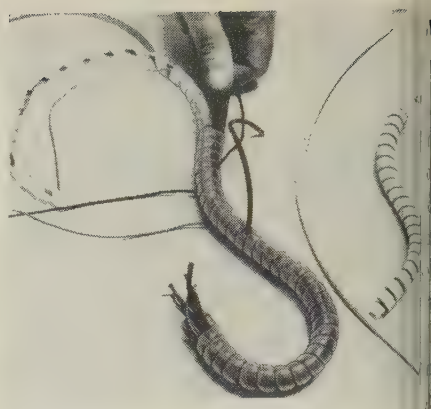


speed. Using easy-to-bend Perma-Form, operators reportedly can close the coil retainer stock on the coil wires and stator assembly with a minimum of effort and time. Identification numbers can be stamped into the surface, eliminating the stamping of end laminations. W. J. Ruscoe Co., Akron 1, Ohio.

Print No. Ins. 115 on Reader Service Card

Wire and Cable Bindings

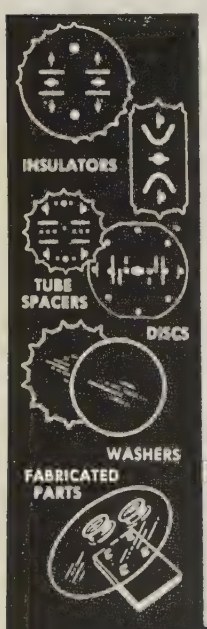
Expanded line of Heli-Tube spirally cut tubing for binding electrical wires



into cables is said to hold wire bundles tightly and permit individual wires, taps, or lead-offs to be led out at any point. In addition, it wraps on and off as easily as tape. Line now includes five standard materials: clear polyethylene, nylon, ultraviolet resistant polyethylene, fire-resistant DuPont "Rulan," and a high melting point linear polyethylene. Excellent electrical insulation, protection against abrasion, resistance to chemicals and solvents, and impermeability to moisture are claimed. M. M. Newman Corp., Dept. NR-30, 79 Clifton Ave., Marblehead, Mass.

Print No. Ins. 116 on Reader Service Card

FOR NATURAL MICA



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Specify "F.M.C." for

- **MICA EXPERIENCE:** Since 1917
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PRECISION MICA FABRICATORS SINCE 1917

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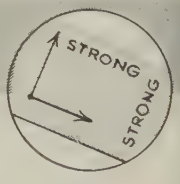
* **Package with Confidence**



New Mystik Brand Super Flextron® Tape No. 6497 Has Bi-Directional Strength

An unique packaging tape. Super strength bi-directional filaments are an integral part of the product—providing equal strength in both directions. The tape is water and moisture proof. Excellent quick stick properties and it stays stuck.

TYPICAL APPLICATIONS: Strapping and holding heavy machinery parts—sealing heavy-content packages for shipment—holding loose parts in place for assembly of refrigerators and stoves—heavy banding on corrugated, fiberboard and wooden cartons—strapping tubes, rods and lumber—banding groups of cartons on pallets. Frequently replaces steel strapping.

(Conforms to Government Specifications PPP-T-97-Type 11)

Write for full information on Mystik Super Flextron No. 6497 and other Mystik brand packaging tapes.

Mystik Adhesive Products, Inc.
2635 N. Kildare Ave.,
Chicago 39, Illinois

MYSTIK BRAND TAPES SELF-STIK

PROTECTIVE COVERING MATERIALS—TAPES THAT TALK

Print Ins. 21 on Reader Service Card

allized Cast "Teflon" Film

new vacuum deposition, produc--type technique now permits alu-um metallizing of Teflon films in tinuous lengths in films from 0375" to .004". Known as type CM Teflon film, the new medium can metallized on one or both surfaces h or without an insulated margin. e CM film reportedly has already with success in capacitor applica-ns and is currently being evaluated a broad variety of uses requiring h temperature and high reliability racteristics. Among the many ap-cations said to exist for type CM : transformers, reflectors, antenna cuitry, high temperature electro-tic shielding, etc. Dilectrix Corp., en Blvd. & Grand Ave., Farming-dale, N.Y.

Print No. Ins. 117 on Reader Service Card

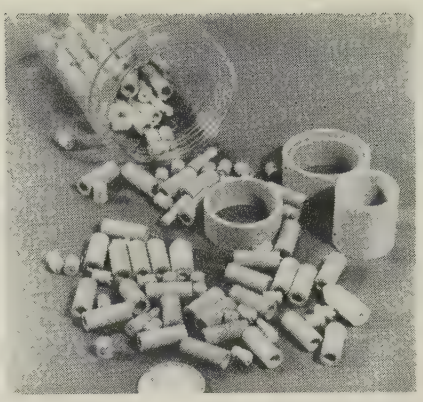
Spray-Can Solvent Cleans Motors

A chemical solvent which is said to completely clean electrical motors and parts of oil, grease, dirt, dust, and other materials is now available in aerosol containers. Called "Swish Elektrokleen," the solvent also reportedly "demoisturizes" equipment which has been short-circuited by water. It is claimed to leave no residue to pick up dirt. It is non-combustible, and will actually extinguish a flame if sprayed on it. It is further said to be non-toxic and non-corrosive—it will not stain or corrode metals and will not attack paint. Price is $1.30 per 16-oz can. Montgomery Chemical Co., Jenkintown, Pa.

Print No. Ins. 118 on Reader Service Card

High Temperature Ceramic Bushings

High temperature ceramic bushings are said to be capable of withstanding 2000°F continuous operating temperatures. Use in electrical insulators, semiconductor tooling, and other applications is reported. The



bushings are available in diameters ranging from 12" OD down to .028". Duramic Products Inc., 426 Commercial Ave., Palisades Park, N.J.

Print No. Ins. 119 on Reader Service Card

New Insulated Thermocouple Wire Protects Against Shock and Vibration

A new type of insulated thermocouple wire that is said to be particularly effective in applications subject to severe mechanical loading or vibration, "Insupack," is conventionally-insulated small diameter, thermocouple wire sheathed in metal tubing. Supplied in all base metal calibrations in single or duplex pairs, standard

ll
our
lectrical
nsulating
eeds

Armature Twines, Wedges
Bi-Seal Tapes
Coil Winding Machines
Cotton Tapes and Webbings
Cotton Sleevings
Commutators
Cuffed Insulating Papers
Extruded Plastic Tubings
Fiberglas Tapes, Cords and Sleevings
Friction and Rubber Tapes
Insulating Varnishes and Compounds
Low-Pressure Laminates
Magnet Wire
Mica—Built-up and Raw
Motor Enamels
Pressure Sensitive Tapes
Safe-T-Seal
Silicone Rubber Fiberglas Tubings
Silicone Wedges
Silicone Varnish and Grease
Teflon Tape
Undercutting Machines and Saws
Varnished Sleevings and Tubings—Cotton, fiberglas and rayon
Varnished Cambric, Paper and Tapes
Vinyl Fiberglas Tubings and Sleevings
Vinyl Tape
Wire Brushes

You'll Want the Handy New Glenn Reference Folder for Your File—Write for it Today!"

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. J. Glenn and Company

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5 Westbrook Road, Dayton, O., CRestview 5-3354
15 N. Boyd Way, Milwaukee, Wis., FLagstone 2-7262

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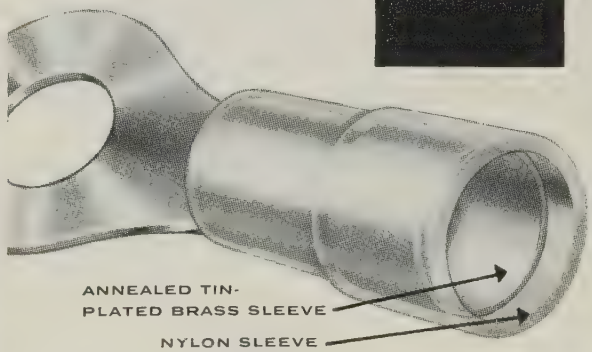
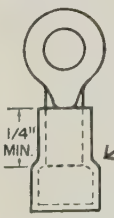
new! from ETC



AVIKRIMP* solderless terminals

...the ultimate in high-performance design



Permanently attached brass sleeve adds extra barrel strength and permanently anchors the wire insulation to the terminal for full protection against stress and vibration. Extending beyond the brass sleeve is a permanently attached NYLON sleeve—no other insulation needed. All tongue types. Color-coded for wire range. Write today for samples, prices.

*Trade Mark

ETC INCORPORATED
990 East 67th Street, Cleveland 3, Ohio

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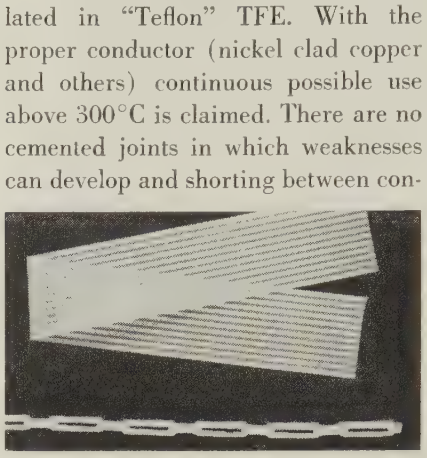
wire diameters are 1/8", 3/16", and 1/4" with "Fiberglas," "Teflon," polyvinyl, or "Refrasil" insulation. Copper, 304 stainless steel, and "Inconel" are standard sheaths—other sheath materials to special order. Insupack wire is easily fabricated for use as thermocouple elements or extension wire right on the job site. The metal sheath provides mechanical protection and is said to enable the wire to be used at temperatures above the continuous temperature rating specified for identical insulations without sheaths. Insupack can be supplied in lengths up to 50 ft—standard 25 ft lengths in one-foot increments. Pyrometer Co. of America Inc., Pennsdel, Pa.

Print No. Ins. 120 on Reader Service Card

Strip Cables for 300°C Uses

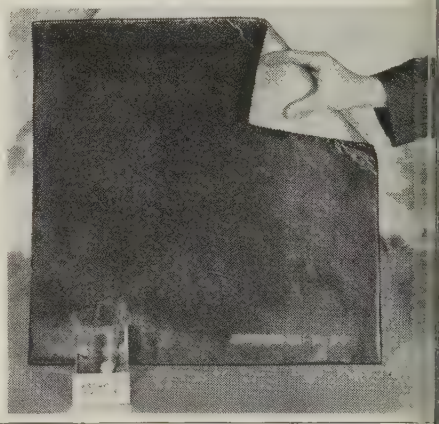
A new "Multi-Tet" cable construction has strip conductors encapsulated in "Teflon" TFE. With the proper conductor (nickel clad copper and others) continuous possible use above 300°C is claimed. There are no cemented joints in which weaknesses can develop and shorting between conductors is said to be nearly impossible. Strip conductors of any size can be used with any desired spacing. The cables are made up to 3" wide and with insulation thickness as thin as .003". They are also available with bondable surfaces. W. L. Gore & Associates Inc., 487 Papermill Road, Newark, Del.



Print No. Ins. 121 on Reader Service Card

Flexible Foam Microwave Absorber Is Weatherproof and Fuelproof

A new broadband microwave absorber, "Eccosorb" AN-W, is a weatherproof, fuelproof, flexible foam microwave absorber for use outdoors or in situations where the absorber will be in contact with fuel, lubricants, or hydraulic fluids. It is particularly useful in airborne applications such as radar nacelles. The material is said to be extremely light in weight and can be subjected to low pressure—such as occurs at high altitude or in outer space. Several absorbers are available in the range from L band through K band with maximum power



You Can Pack a Big Protective Wallop Into MICA Insulation Parts

Recent technical developments have made mica even more versatile, more able to solve your insulation problems. It's available in more forms than ever before —from miniature insulation parts that pack an enormous protective wallop into tiny, critical electronic components . . . to huge manufactured mica pieces which must shrug off punishing abuse in power equipment. Because of the many forms in which Asheville-Schoonmaker mica is available, its properties can be varied to suit your specific needs and applications . . . extreme heat resistance, high strength, flexibility, and space savings are just a few of these characteristics. And all forms of mica feature exceptional electrical insulation qualities.

Ask for more information and prices, today.

MICA **Asheville-Schoonmaker Mica Co.**

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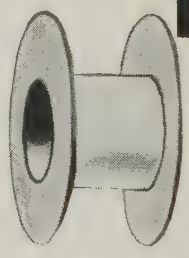
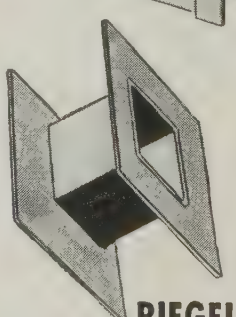
. . . . Chicago 39, Ill., 1608 N. Meade Ave. . . . .
. . . . . New York 13, N.Y., 271 Church St. . . . . .
. . Rocky River, Cleveland, Ohio, P. O. Box 2862 . .

Print Ins. 24 on Reader Service Card

COATED

Electronic Board by Riegel





Custom coating for electrical industries is a Riegel specialty. Boards may be coated with natural or synthetic resins in different weights. Combines high strength, purity, flexibility, ply adhesion and dielectric strength. Write us about your requirements.

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nt No. Ins. 122 on Reader Service Card

lyester Coated Fabric

New "Irvington" 4222 resin coated bric, said to combine the advantages many different coatings in one oduct, is coated with a modified lyester resin. The resin is applied nylon, "Dacron," and glass cloth other types of fabrics in vari- s weaves to provide desired tear rength properties. It reportedly has perior sunlight and ozone resist- ce, remains flexible at —80°F 6.8°C), will operate at 350°F 90.5°C) without degradation, and s excellent resistance to mildew, nd, and salt water. Its abrasion re- stance is called greater than that of other commonly used coatings, th very high adhesion to base cloth. ne new fabric also is said to have cellent solvent resistance to aro- atic, aliphatic, ketones, and esters room temperature. Flexibility of the aterial is permanent, since it con- ins no plasticizers which could bleed out with age. Minnesota Mining and Manufacturing Co., Irvington Div., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 123 on Reader Service Card

New Micro-Fine Metal Oxides For Ceramics, Reinforcements

New micro-fine metal oxides available in development quantities include "Micria" AD and AL (aluminas), Micria TIS (titania), and Micria ZR (zirconia). Numerous other microfine oxides of various metals in both spheroidal and laminar forms also have been produced. The flakes of Micria AL are so small that a penny would purchase some 2,000-billion particles. In the ceramics industry, the Micrias are said to be capable of developing a micro-crystalline structure of high strength and fine texture and can be formed into complex shapes by slip-casting and pressing. As reinforcing agents, they reportedly offer advantages in oxide-strengthened metals and in plastics and elastomers. Monsanto Chemical Co., Research & Engineering Div., Development Dept., 800 N. Lindbergh Blvd., St. Louis 66, Mo.

Print No. Ins. 124 on Reader Service Card

Resin Solvent for Cleaning, Salvaging Electronic Components

RCM Resin Solvent is said to be effective in salvaging electronic components which have been embedded in epoxy or polyester resins, and for use in cleaning molds and equipment used during casting or potting applications. The embedded component is merely placed into a container of the solvent. After the resin has disintegrated, usually overnight, the component is removed. Resin Consultants & Manufacturing Co. Inc., 132 Nassau St., New York 38.

Print No. Ins. 125 on Reader Service Card

Quick Disconnect Terminals

A new series of "Quick Disconnect" terminals are designed for automotive, appliance, and many switch and control applications. The new terminals give push-on, high-pressure, spring-loaded connections that incorporate a special locking action. The series includes insulated and non-insulated models, straight and flag

TONOX
EPOXY CURING AGENT
for encapsulating electrical components

gives LONG POT LIFE

- minimum vapor hazard and skin staining
- low cost
- high strength
- high heat distortion point
- high moisture resistance

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Brady Pressure-Sensitive, All-Temperature Wire Markers for small gage wires are exactly ¾" long to fit wires under ¼" o.d. They cut your small gage wire marking costs in half because:

1. They cost half the price of Standard Markers, and
2. They go on the wire *twice* as fast.

You can't drop Brady Wire Markers — *they stick to your finger from Card to wire.** Stick and *stay stuck* — at temperatures to 300° F.! Choose from over 3,000 different stock markers—both Standard and Small Gage Size. Stocked by Brady Distributors in all principal cities. Specials made to order. Write for big new bulletin and free testing samples *today!*

*Remember, too, Brady makes the only marker that can be machine applied.

W. H. BRADY CO., 749 West Glendale Ave., Milwaukee 9, Wis.

Manufacturers of Quality Pressure-Sensitive Industrial Tape Products, Self-Bonding Nameplates, Automatic Machines for Dispensing Labels, Nameplates, Masks and Tape • Est. 1914. 94

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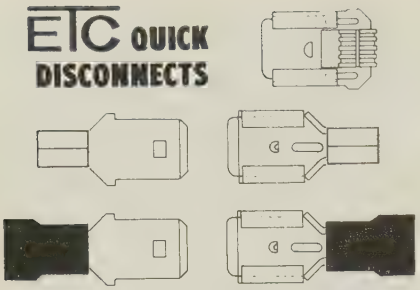
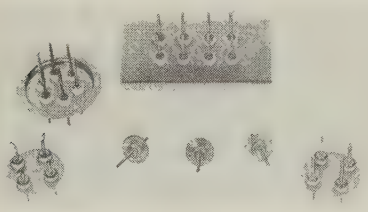


types. Wire range is 18-14 AWG. ETC Inc., 990 E. 67th St., Cleveland 3, Ohio.

Print No. Ins. 126 on Reader Service Card

Ceramic Insulated Terminal Headers

The novel use of standardized insulating ceramics in a new line of metal-ceramic headers makes possible a large assortment of both off-the-shelf and custom units, with no ceramic

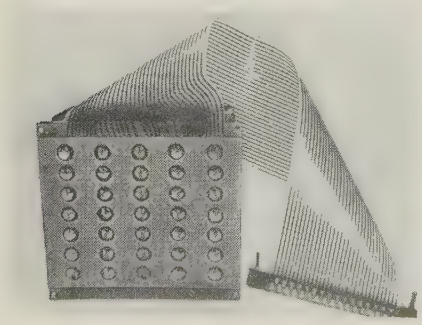


tooling requirements. Standard single and multiple terminal headers are available for application in electronic tubes, relays, transformers, missile components, and other devices requiring vacuum tight, high temperature, ruggedized seals. These copper-brazed alumina to matched alloy assemblies are said to be suitable for operation up to 1000°C, and are all helium leak checked and thermal shock tested. High mechanical strength and good resistance to chemicals and nuclear radiation are claimed. Radian Laboratories Inc., P. O. Box 454, Mineola, N. Y.

Print No. Ins. 127 on Reader Service Card

Flexible Vinyl Sheeting Printed Circuit

Flexible printed circuit is made by sandwiching copper conductors between flexible layers of insulation. Vinyl sheeting is used as the flexible insulator for most applications. It is

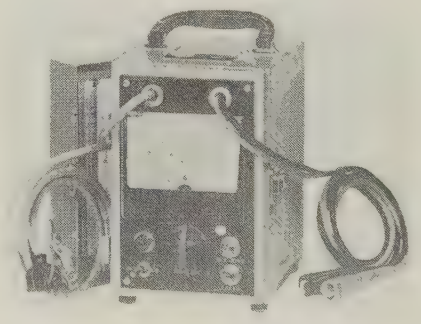


reportedly low in cost and provides top insulating properties, good chemical resistance, and good physical characteristics to the circuit. Inertness is said to make the printed circuits especially valuable for service under corrosive conditions. Small size and light weight add to their value in the aircraft and missile industries. The possibility of their use in the automotive electric circuits and other mass production applications is under investigation. Sanders Associates Inc., Nashua, N. H.

Print No. Ins. 128 on Reader Service Card

Audible Electrical Insulation Tester

Portable insulation breakdown testers featuring an automatic and audible "squawker" that sounds at preset leakage current values enables production and maintenance testers of electrical equipment to work at a substantial distance from the "Hypot" test set. The operator need not take his attention off the point of test to watch for visual breakdown indication while moving test prods about the terminals of a multi-conductor cable, or when checking a large group of motors arranged on a warehouse floor. Models are available with a-c test potential output up to 6000 v. The visual and audible leakage indicators have an adjustment range from 300 microamperes to 3 milliamperes as

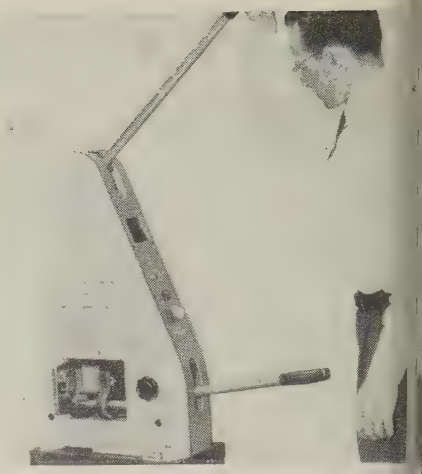


standard and to 10 milliamperes on special order. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 129 on Reader Service Card

Molds Lab or Short Run Plastic Parts

Experimental or prototype thermoplastic parts can be molded with new Unex-Jet injection molder using inexpensive molds. Shot capacity is ½ oz or ¾ cubic inches. Unit price of machine is $595. Technical bulletin sent on request. Hinchman Manufacturing



Co. Inc., 259R First Ave., East, Roselle, N. J.

Print No. Ins. 130 on Reader Service Card

Volt-Ohm-Milliammeter

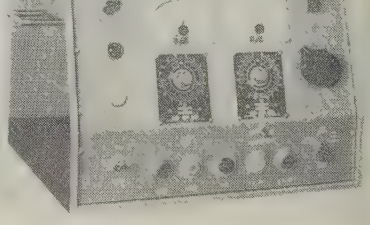
The new EMC model 109 volt-ohm-milliammeter features the use of a 40 microampere 4½″ meter and a-c voltage sensitivity of 10,000 ohms/v. It has 5 d-c voltage ranges to 3,000 at a sensitivity of 20,000 ohms/v; a-c and d-c current ranges; 5 a-c volt

age ranges to 3,000 v at a sensitivity of 10,000 ohms/v; and 3 resistance ranges to 20 megohms. Housed in a high impact molded bakelite case, it is available in either wired or kit form. Electronic Measurements Corp., 625 Broadway, New York 12.

Print No. Ins. 131 on Reader Service Card

Automated High Voltage Test Set

A new high voltage breakdown test set has automatic control features that are said to make possible more dependable and more accurate testing with greater safety to equipment and

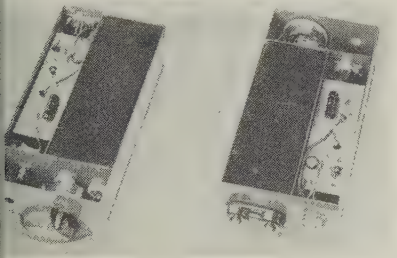


erator. Some of these automatic tures in the Model 8514 "Hypot" automatic rate of rise, adjustable tomatic shut-off of voltage and leak- current meter, a timer to auto- tically shunt the leakage current croammeter for 0-5 minutes while pacitance loads are drawing up to ma available for rapid charging, imer to apply high voltage for pre- interval of 1-15 minutes, and an tomatic reset of voltage control with gh speed return to zero. An auto- tic alarm is adjustable to selected kage current limit, and a meter mory circuit retains reading of gh voltage at point of failure for n under test. Associated Research ., 3777 W. Belmont Ave., Chicago

t No. Ins. 132 on Reader Service Card

w Magnet Wire Continuity Tester

A new magnet wire continuity ter is designed for detection of in- ation breaks and recording and



tification of wire insulation qual- A selector switch (photo left) pro- es nominal open circuit voltages of 00, 1500, and 750. Maximum out- current is limited to .5 ma. The k of the unit (photo right) shows two high voltage cables to test the mple and the male connectors. The rice will not contaminate wire dur- tests or draw currents sufficient to nage the wire. Unit can be used h all types of enamel insulation and rubber covered wire. It is designed feed a graph recorder which will vide a continuous, permanent rec- . General Electric Co., Schenec- y 5, N. Y.

t No. Ins. 133 on Reader Service Card

v, Compact, Vertical Injection rtion Molding Machines

Two new, compact vertical-injec- n molding machines for insert, con- t, and plug molding are available 1 oz and 2 oz capacities per plastic t and feature an exclusive sliding

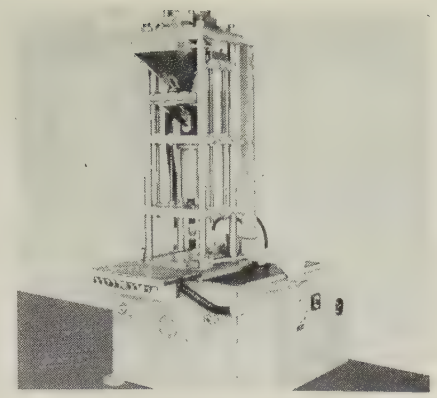
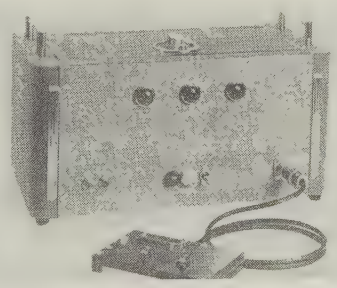


table which permits the operator more freedom of movement in positioning inserts. Push button controls reportedly reduce operator fatigue and increase production. It is stated that molds and cylinders can be changed in minutes and dry run production is 600 cycles per hour. Mold sets for the machines are said to cost approximately half the price of conventional models. Progressive Tool and Die Co., 530 Boston Turnpike, Shrewsbury, Mass.

Print No. Ins. 134 on Reader Service Card

Automatic Resistance Limits Bridge for Production Testing

The new Model 8516 pilotal ohmmeter provides precision automatic production testing of components and assemblies within present resistance ranges. This automatic limits bridge indicates on pilot lamps whether resistance is less than, within, or greater than the predetermined limit. The standard model covers a range of 3.75 to 4.00 ohms, but may be supplied to



cover any desired limits between resistance ranges of 0.1 and 1 million ohms or higher. Accuracy reportedly is better than 0.05 ohms. Operation requires only connection to leads of the item being tested. The model 8516 operates from 115 v, 50-60 cycle line and has very low voltage at test terminals for operator safety. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 135 on Reader Service Card

Correction

A "News and Views" item in the November issue of *Insulation* erroneously described the I-T-E Circuit Breaker Co. laboratory in Los Angeles as having the "only high-current testing setup on the Coast." The fact is, Jennings Radio Manufacturing Corp., San Jose, Cal., also has a high voltage

laboratory with many comparable facilities for research and production testing of high voltage and high current switches and switchgear. D-C and 60 cycle power equipment at Jennings includes a complete substation with all voltages up to 120 kv, transformers to produce momentary currents in excess of 200,000 amps, and three large reactors, each designed for 120 kv operation at 300 amps.

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New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card in this issue. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Catalog of Laminated Plastics and Vulcanized Fibre

Basic application information and detailed engineering data on laminated plastics and vulcanized fibre for use in electrical, electronic, and other components is given in a new condensed catalog. Engineering, sales, fabricating, and shipping services are also described. 8 pages. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 201 on Reader Service Card

Bulletin on Why and Where to Use Silicone Rubber Insulated Cable

New bulletin CDS-208 lists insulation properties of G-E Class 900 electrical grade silicone rubber and discusses the major application areas in which silicone insulated cable has proven its performance. Savings in installation costs are illustrated and properties of silicone rubber vital to cable applications are compared with those of other materials. 5 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 202 on Reader Service Card

Catalog of Chemicals, Polymers, Resins, Adhesives, and Coatings

New product catalog and directory lists specifications, end-uses, and other technical data for more than 1000 products, including basic chemicals, monomers, polymers, resins, electrical insulation, adhesives, coating materials, plastic products, fine chemicals, organic intermediates, and bio-chemical reagents. Sales and service centers, plant locations, warehouse points, and overseas manufacturing subsidiaries are also listed. The directory is cross-indexed by product name and end-use. 36 pages. Dept. H, The Borden Chemical Co., 350 Madison Ave., New York 17.

Print No. Ins. 203 on Reader Service Card

Catalog of Wire, Cable, Flexible Tubing, Tape, and Lacing Cord

New catalog No. I-59 lists 324 wire and cable items, with application information and specifications. The catalog also contains a section on 70 tubing and sleeving items, and has separate pages devoted to zipper tubing, lacing cord, and tapes. Special facilities for custom wire and cable manufacture and test lead line are also described. 16 pages. Alpha Wire Corp., 200 Varick St., New York 14.

Print No. Ins. 204 on Reader Service Card

Bulletin on Heat-Resistant Glass-Epoxy Laminates

Grade GEC-111 glass-base, epoxy-resin laminated plastic and grades GEC-111 E and GEC-111 R copper-clad laminates are described in new technical data bulletins (Nos. 51.5.18 and 51.5.19). Electrical properties, characteristics, and other data are provided. 2 pages each. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 205 on Reader Service Card

Bulletins Describe High Voltage A-C Sets for Insulation Testing

Bulletins GEA-6843 and 6839 describe high voltage a-c test sets rated 50,000 to 350,000 test voltage, 5 to 1,000 kva, and lower rated test sets 20,000 to 50,000 volts, 2 kva, for performing dielectric tests on insulating materials, motors and generators, transformers, bushings, wire and cable, components, oil (ASTM method) and other apparatus. Complete information on product features, characteristics, and operation of mobile and stationary high potential a-c test sets is given with pictures, dimensional drawings, and rating and weight tables. 4 pages. General Electric Co., Schenectady 5, N.Y.

Print No. Ins. 206 on Reader Service Card

Catalog of Insulating Nuts, Screws, Enamel, and Holding Devices

New catalog covers "Lucite" ca

s, nylon screws, and a wide range holding devices for electrical and tronic components. Includes specations, prices, sizes, applications, lication instructions, and advanes. The outstanding features and cifications of "Dalcoat" B hi-dictric enamel are also listed. 62 es. Atlas E-E Corp., 47 Prospect Woburn, Mass.

No. Ins. 207 on Reader Service Card

on Insulating Grommet Brochure

New brochure describes a one-ce, nylon insulating flip grommet, nts out unusual safety and installa- advantages, and gives specifica- s and installation instructions. 4 es. Western Sky Industries, 21301 ud Way, Hayward, Cal.

No. Ins. 208 on Reader Service Card

alog Sheet on Nylon Connector ting Forms for Flexible Epoxy Resin

New catalog sheet describes forms potting electrical cable connectors ch are an economical means of seing an excellent seal against the cts of moisture, oil, hydraulic ds, salt spray, and fungus while ieving a professional finish. PF ing form sizes to fit standard contor back shells from ½" ID to " ID are listed. 1 page. Chemical . (Dept. EC-L3), Electronic Protion and Development Inc., 501 th Prairie Ave., Hawthorne, Cal.

No. Ins. 209 on Reader Service Card

rint on Laminated Plastics forming Procedures

reprint tells what types of lamied plastics are recommended for forming, discusses mold design, s correct temperatures and pres- s for best results, and describes inated plastic and vulcanized fibre erials for electrical, electronic, other applications. A table lists blister time for sheets of various knesses. 4 pages. Taylor Fibre Norristown, Pa.

No. Ins. 210 on Reader Service Card

rature on Mixing and ering Equipment for Potting

wo new brochures describe equipt for mixing and metering sealcoatings, potting compounds, adves, epoxies, and catalyzed mates. Form 101, 4 pages, describes features and advantages of new Model SP1558 portable automatic "Shot" meter-mixer for two-part compounds and adhesives. The other brochure (form 102, 6 pages) covers air powered 1600 Series automatic metering, mixing, and dispensing equipment for continuous operation with viscous compounds in large volume. Pyles Industries Inc., 20855 Telegraph Rd., Detroit 41.

Print No. Ins. 211 on Reader Service Card

New Bulletin on Nylon and "Nylatron" Stock Shapes

New bulletin contains 22 case histories, including an electrical insulation application, in which designers have saved money by using nylon and Nylatron GS stock shapes in place of other materials. A table of nylon rod, plate, strip, disc, tubing, bushing stock, and tubular bar sizes available is included. 8 pages. The Polymer Corp. of Pennsylvania, Reading, Pa.

Print No. Ins. 212 on Reader Service Card

Polyester Laminate Data Sheet

New data sheet gives general properties of "Haysite" polyester laminates and describes applications in the electrical industry, including use in motors and generators, switchgear and control equipment, transformers and reactors, and panel boards. Grade selection information is also provided. 2 pages. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.

Print No. Ins. 213 on Reader Service Card

New Brochure on Thermoplastic Molding and Extrusion Material

New brochure contains extensive technical information on Baker PL-11 resin, a thermoplastic acrylic-type polymer suitable for injection molding and extrusion. Commercial Development Dept., J. T. Baker Chemical Co., Phillipsburg, N.J.

Print No. Ins. 214 on Reader Service Card

Self-Locking Fastener Brochure

New illustrated brochure describes self-locking fasteners and nylon flip grommets for use in electronic equipment, jet aircraft, and missiles. Data on engineering specifications, test results, strength and weight, safety, and tools and methods of installing are included. 20 pages. Western Sky Indus-

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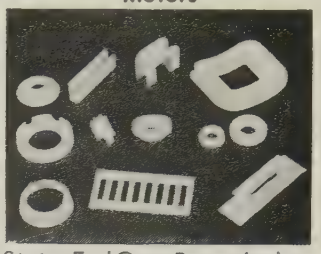

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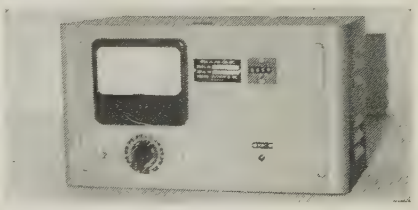

Improved series of Peschel standard wire sparkers feature electronic fault relay which provides fast, accurate, and reliable indication of faults, even at very low output voltages. Low cost units with a-c or d-c output can be used at speeds up to 2,000 ft./min. with 5" electrodes (400 fpm per 1" of electrode). Suitable for extruder or respooler use, they have selenium rectifiers for ruggedness and long life, as well as provision for lock-in type white light with reset and buzzer fault indication in addition to magnetic counter. Current is limited for safety. Operation is reliable down to 5% of maximum output voltage. May also be used as a potential tester for checking cable. Many other advantages including easy operation.

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tries, 21301 Cloud Way, Hayward, Cal.

Print No. Ins. 215 on Reader Service Card

Molded "Delrin" Parts Bulletin

Bulletin outlines new designs, products, and production economies available through facilities for automatic injection molding of tiny Delrin components. Detailed engineering information and established and potential uses for the acetal resin are presented. Bulletin also includes a table of properties and a table of approximate dimensions and weights in which molded parts can be specified. 8 pages. Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N.Y.

Print No. Ins. 216 on Reader Service Card

Nylon Flip Grommet Samples

New sample card holds three WSI one-piece, solid nylon flip grommets. One of the grommets, hung on a key chain, is open. The other two, in white and color, are installed through holes in the laminated plastic card as in regular installation. Imprinting identifies the items and lists salient features. Western Sky Industries, 21301 Cloud

Way, Hayward, Cal.

Print No. Ins. 217 on Reader Service Card

Literature on Chemical Resistance Of Phenolic Molding Compounds

New "Molding Technical Release No. 36" lists the chemical resistance of seven phenolic molding compounds to acids, alkalies, solvents, and common mixtures. 12 pages. Union Carbide Plastics Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17.

Print No. Ins. 218 on Reader Service Card

Cross Reference Manual Simplifies Coaxial Connector Selection

A comprehensive cross reference manual is said to simplify specifying and ordering of rf coaxial cable connectors and to give buyers a quick lead to alternate sources when periodi spot shortages are encountered. It pro vides the numbers assigned by leadin connector manufacturers, large user and BuShips; lists applicable militar standards; and matches equivalen connectors with more than 2,000 stoc types. It is kept up to date by pag additions and revisions. 46 pages Gremar Manufacturing Co. Inc., Wakefield Ave., Wakefield, Mass.

Print No. Ins. 219 on Reader Service Card

Oven Reference Catalog

New comprehensive reference cata log for procuring personnel in th electrical and other industries give basic information about laborator pilot plant, and small batch-type pro duction ovens. Tabs help to loca applications. Complete informati concerning each application is provi ed in specialized bulletins contain in each section. 138 pages. Despat Oven Co., 619 S. E. 8th St., Minn apolis 14, Minn.

Print No. Ins. 220 on Reader Service Card

New Slitting Machine Brochure

New brochure describes the adva tages and outstanding features of wh is said to be the only machine co pletely designed for automatic slitti Machine is air operated and electro ically controlled. 8 pages. Lever Ma ufacturing Co. Inc., 120 West 31st St New York 1.

Print No. Ins. 221 on Reader Service Card

"Facts on Testing" Bulletin

"Facts on Testing" No. 5901 d scribes air grips for tensile teste new methods of cutting samples, non-slip textile grip, a new adhesiv tester, a number of innovations a accessories for the Elmendorf tearin tester, and other testing instrume and methods. 4 pages. Thwing-Albe Instrument Co., Penn St. and Pulas Ave., Philadelphia 44.

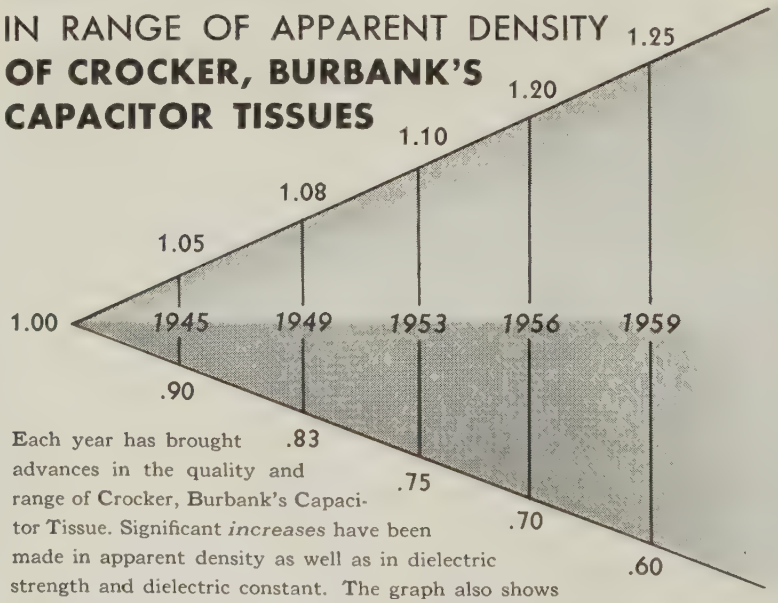
Print No. Ins. 222 on Reader Service Card

New Bulletin on Vertical Injection Molders

New bulletin describes advantage safety features, and specifications two vertical injection machines for i sert, contact, and plug molding. pages. Progressive Tool & Die C 530 Boston Turnpike, Shrewsbu Mass.

Print No. Ins. 223 on Reader Service Card

STEADY GROWTH
IN RANGE OF APPARENT DENSITY
OF CROCKER, BURBANK'S CAPACITOR TISSUES



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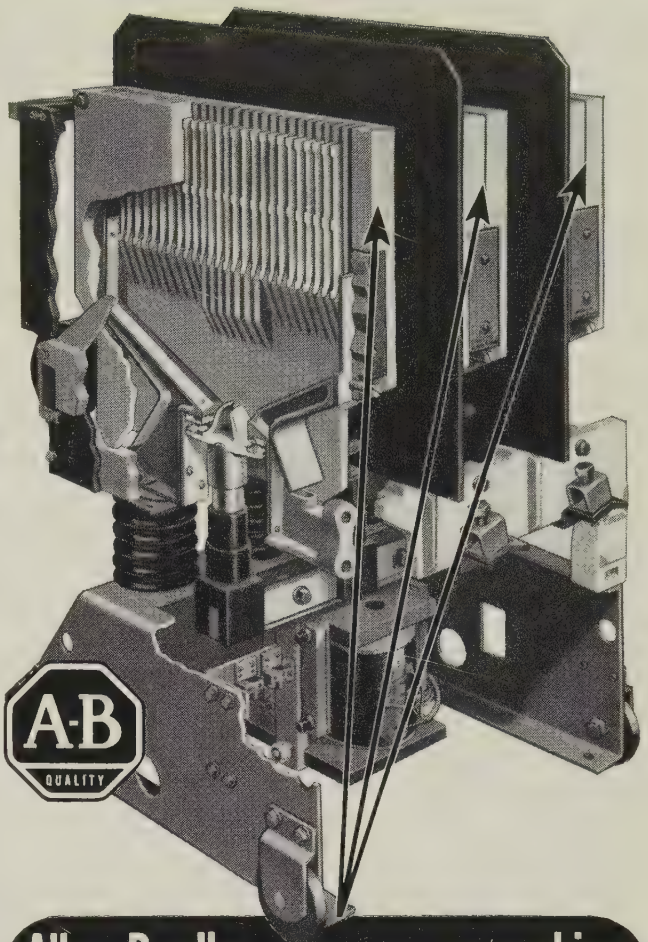

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New Publications

Books

Electrical Engineering for Professional Engineers' Examinations, by John D. Constance. Provides a quick run-through of electrical theory and methods of application, with scores of questions and answers which are typical of those in the examinations. 456 pages, 5⅜″ x 8″, 381 illustrations, $9.50. McGraw-Hill Book Co., 330 W. 42nd St., New York 36.

AWS Soldering Manual. Describes all phases of soldering, including the new techniques developed for miniaturization and printed circuit soldering. Chemical compositions of hundreds of solders are given, together with flux formulations for the various metals. 176 pages, 81 illustrations, and 34 tables. $5. American Welding Society, Dept. T, 33 W. 39th St., New York 18.

Chemical Industry Facts Book (fourth edition). Contains material on virtually every aspect of the field. $1.25. Manufacturing Chemists' Association, 1825 Connecticut Ave., N.W., Washington 9, D.C.

The following 10 books were published in 1959 by the Reinhold Publishing Corp., 430 Park Ave., New York 22.

Source Book of the New Plastics, by Herbert R. Simonds. 362 pages, $10.

Amino Resins, by John F. Blais. 256 pages, $4.95.

Phenolic Resins, by David F. Gould. 272 pages, $5.75.

Silicones, by Robert N. Meals and Fredericks M. Lewis. 304 pages, $5.95.

Hot Organic Coatings, by Raymond B. Seymour. 225 pages, $7.50.

Introduction to Rubber Technology, edited by Maurice Morton. 600 pages, $10.

Welding of Plastics, by J. A. Neumann and F. J. Bockhoff. 288 pages, $7.25.

Radioisotopes for Industry, by Robert S. Rochlin and Warner W. Schultz. 210 pages, $4.75.

Asbestos: Its Industrial Applications, by D. V. Rosato. 220 pages, $5.75.

Processing of Thermoplastic Ma rials, edited by E. C. Bernhardt. Spo sored by the Society of Plastic En neers Inc. 706 pages, $18.

Index Translationum, an intern tional bibliography listing appro mately 28,000 titles of books issu (1957) in translation from 65 co tries in more than 200 languag Clothbound, $20; paperbound, $ Unesco Publications Center, 801 3 Ave., New York 22.

Handbook on the International E change of Publications. More than percent of the material in this seco and revised edition is new. It c tains an alphabetical index to co tries and to subjects; and an in to towns. $7.50 for paperback edi and $8.50 for clothbound edi Unesco Publications Center, 801 3 Ave., New York 22.

The following three books are a able from Interscience Publishers I 250 Fifth Ave., New York 1.

Linear and Stereoregular Addi Polymers, by Norman G. Gaylord H. F. Mark. Provides a summary constructive interpretation of mass of original and patent literat which has appeared in the few y since the discovery of stereospe polymerization. 582 pages, $17.50

Analytical Chemistry of Polym Part I—Analysis of Monomers Polymeric Materials, edited by G don M. Kline. A collection of analytical methods which have pro useful to research and control ch ists in the testing of commercial m omers and polymers. 684 pa $16.50.

Compression and Transfer Mo ing of Plastics, by J. Butler. pages, $5.75. Published for The P tics Institute.

OTS Reports

The following reports, primaril research sponsored by the Ar Services, are available from the O of Technical Services, U. S. Dep Commerce, Washington 25, D.C. der by number.

PB 151726, Unconventional

Power Sources, by P. A. Mcm, Oklahoma Institute of Techy. 104 pages, $2.50.

151525, The Preparation and acteristics of Thin Ferromagnetic. 139 pages, $2.75.

151749, Properties of Ferrites Their Applications to Microwave ms, by F. Reggia and R. D. ner, Diamond Ordnance Fuze ratories. 59 pages, $1.50.

151526, Volumetric Determinaof Phthalic Anhydride in Certain l Resins, by G. G. Esposito, Aber- Proving Ground. 8 pages, 50

151670, Salvage of Flooded rical Equipment, by H. R. Baker . B. Leach, U. S. Naval Research ratory. 21 pages, 75 cents.

151557, Prototype Model of an natic X-Band Microwave Imped- Recorder, by W. F. Gabriel, l Research Laboratory. The de- s also suited for measurement of tric constant. 34 pages $1.

omic Energy Commission Reh Reports, Price List No. 32.

O-16395 (Addendum), Instruand Electrical Standard Prac- for MTR and ETR. 12 pages, nts.

R-373, Ceramics and Refrac-. A catalog of technical reports. ages, 10 cents.

talog No. 978. A new list of comial standards available under 22 fications including electrical and anical equipment and plastics. harge. Order by number from nodity Standards Div., U. S. of Commerce, Washington 25,

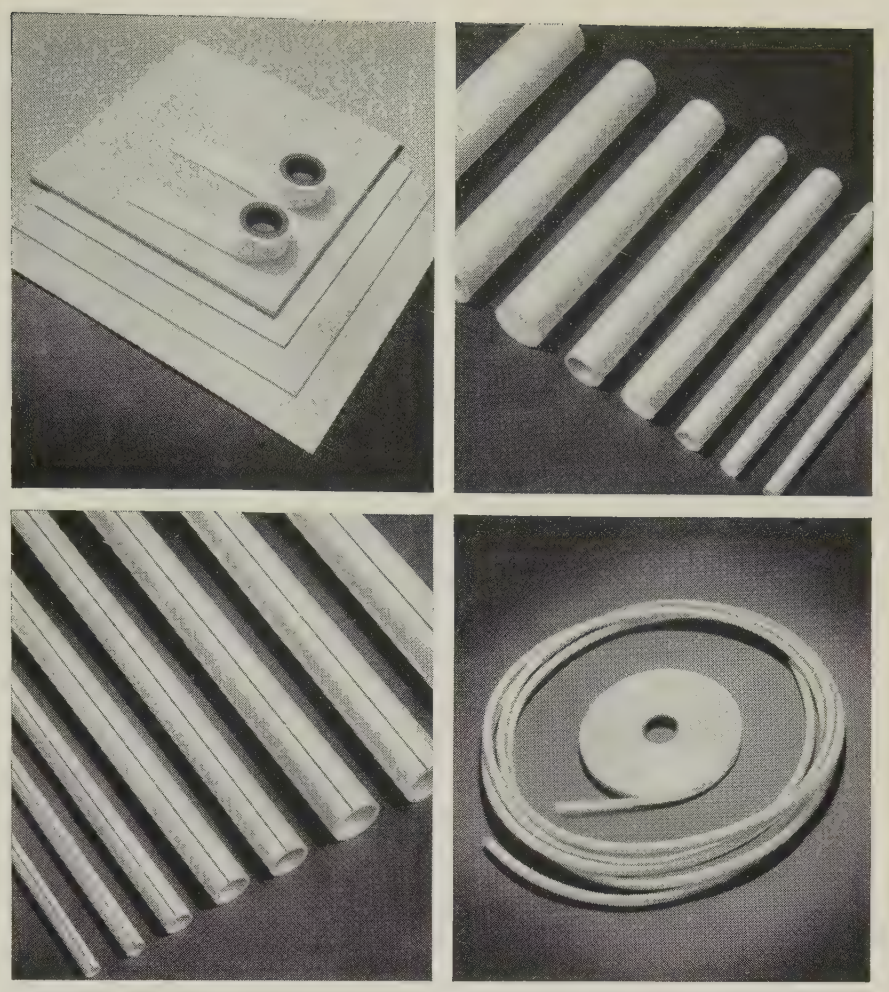
Publications

e following are new publications e American Society for Testing rials, 1916 Race St., Philadel-3.

anscript of the First Forum on ear Problems. Single copies availfree.

1676, Test for Frictional Characics of Enameled Magnet Wire for n Winding Filled Coils.

1678-59T, Method of Testing ble Vinyl Plastic Coated Sleeving for Electrical Insulation.



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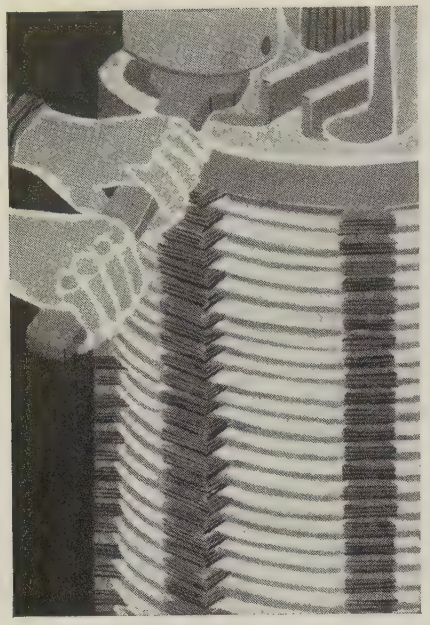

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Ask for Underwriters' Laboratories report #E3987. Write Board Products Sales, West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, New York.

West Virginia Pulp and Paper

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Dates to Circle

Meeting and Convention Notices

Jan. 11-13 . . . Sixth National Symposium on Reliability and Quality Control, sponsored by ASQC, AIEE, IRE, and EIA, Statler-Hilton Hotel, Washington, D. C.

Jan. 12-15 . . . SPE, 16th Annual Technical Conference, Conrad Hilton Hotel, Chicago.

Jan. 25-29 . . . Gaillard Seminar on Standardization, Engineering Societies building, New York City.

Jan. 31-Feb. 5 . . . AIEE, Winter General Meeting, Hotel Statler, New York City.

Feb. 1-5 . . . ASTM, Committee Week, Hotel Sherman, Chicago.

Feb. 2-4 . . . SPI, Fifteenth Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago.

Feb. 3-5 . . . IRE, Winter Convention on Military Electronics, Biltmore Hotel, Los Angeles.

Feb. 7-13 . . . National Electrical Week, sponsored by National Electrical Week Committee, 290 Madison Ave., New York 17.

Feb. 11-12 . . . Transistor and Solid State Circuit Conference, sponsored by AIEE, IRE, and the University of Pennsylvania. University of Pennsylvania Campus, Philadelphia, Pa.

Mar. 21-23 . . . First National Electric House Heating Exposition, Electric House Heating Equipment Section, NEMA, Sherman Hotel, Chicago.

Mar. 21-24 . . . IRE, National Convention, Coliseum and Waldorf-Astoria Hotel, New York City.

Mar. 23-26 . . . Electrical Maintenance Engineers Assn. of Southern California, Electrical Industry Show and Lighting Exposition, Shrine Exposition Hall, Los Angeles.

Apr. 3-8 . . . Nuclear Congress, Engineers Joint Congress, sponsored by AIEE, IRE, and ACM. New York, N. Y.

Apr. 5-9 . . . Ninth Electrical Engineers Exhibition, Assn. of Supervising Electrical Engineers, Earls Court, London.

Apr. 6-8 . . . Institute of Environment Sciences, National Meeting and Exhib Biltmore Hotel, Los Angeles.

Apr. 8-9 . . . SPI, 17th Western Secti Conference, New Riviera Hotel, Pal Springs, Calif.

Apr. 20-22 . . . Twelfth Annual Sou western Conference and Electroni Show, sponsored by Houston Secti IRE, Shamrock Hilton Hotel, Houst Texas.

Apr. 25-26 . . . SPI, 18th Annual Canad Section Conference, London Hotel, L don, Ont., Canada.

Apr. 25-29 . . . American Welding Soci Annual Meeting and Welding Sh Biltmore Hotel and Great Western E hibit Center, Los Angeles.

May 1-5 . . . National Assn. of Electri Distributors, 52nd Annual Conven Dallas.

May 1-5 . . . Electrochemical Society, T nical Meeting, La Salle Hotel, Chica

May 2-4 . . . IRE, National Aeronau Electronics Conference, Dayton, Ohio.

May 2-6 . . . IRE, Western Joint Comp Conference, San Francisco, Cal.

May 7-13 . . . SPI, Annual Conference, Queen of Bermuda (business sess held at sea during New York Bermuda cruise).

May 8-11 . . . NISA, Annual Convent Hotel Fontainebleau, Miami Beach,

May 10-12 . . . IRE, Electronic Compone Conference, Washington, D. C.

May 16-18 . . . IRE, 7th Retec and Tra Show, Olympic Hotel, Seattle, Wash.

May 16-18 . . . Pacific Coast Electrical sociation, Annual Conference, Stard Hotel, Las Vegas, Nevada.

June 10-26 . . . British Exhibition of dustry, Technology, Science, and Cultu sponsored by the Federation of Brit Industries, Coliseum, New York City

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers
ASTM	—American Society for Testing Materials
ASME	—American Society of Mechanical Engineers
ASA	—American Standards Assn.
IRE	—Institute of Radio Engineers
EIA	—Electronic Industries Assn.
NEMA	—National Electrical Manufacturers Assn.
NISA	—National Industrial Service Assn.
SPE	—Society of Plastics Engineers
SPI	—Society of the Plastics Industry
WCEMA	—West Coast Electronic Manufacturers Assn.

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Magnet wires can feature both reliability and soldering ease. FORMVAR (polyvinyl formal) resins, noted for dependability over the past 20 years, can be used in combination with isocyanate-polyester* mixtures to give high quality solderable enamels. In use for almost 3 years, three component enamels of this type have improved flow properties, flexibility and resistance to heat shock and solvents. Coated wire will tin in 5-10 seconds at 350°C.

**Such as Mobay Chemical Co., "Mondur S"-"Multron"*

For wire insulations which permit trouble-free service, lower production costs, and greater efficiency, look to enamels based on FORMVAR. Shawinigan's exacting production controls and applications research keep FORMVAR a dependable ingredient for magnet wire enamels. Shawinigan Resins Corporation, Dept. 5206, Springfield 1, Mass.

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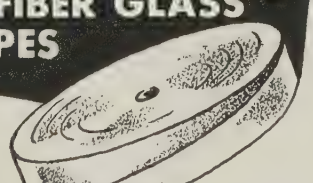

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Industry News

Increased production capacity has been provided *Hullhorst Tools Inc.*, by its recent move to a new plant in Toledo.

A Seattle office and warehouse, carrying special purpose plastics, has been opened by *R. S. Hughes Co. Inc.*, Los Angeles. Don M. Strum has been appointed district manager.

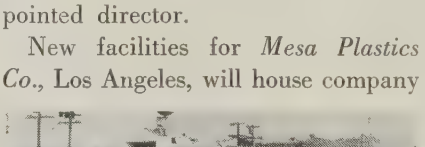
Hercules Powder Co. is expanding its dimethyl terephthalate plant at Burlington, N.J., to triple production. DMT is used in wire insulation.

Robert McKeown Co. Inc., insulation distributor, recently completed a move to a new warehouse and offices in Livingston, N.J.

Construction of a two-story building at the *Spaulding Fibre Co. Inc.'s*, Tonawanda, N. Y. plant will provide additional facilities for research and development in plastic laminates and vulcanized fibre. The building is expected to be completed by March 1960.

Two new labs, Systems Engineering and Equipment Engineering, have been formed within the Electronic Defense Labs. of the Mountain View, Cal. operations of *Sylvania Electronic Systems Div.*, *Sylvania Electrical Products Inc.* J. R. Lien has been appointed director.

New facilities for *Mesa Plastics Co.*, Los Angeles, will house company

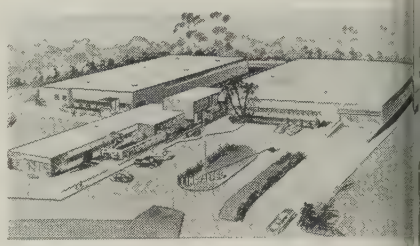


headquarters and will duplicate manufacturing facilities of the company's present plant.

A new Canadian corporation, *Epoxylite of Canada Ltd.*, has been formed. Formulations of the Ft. Erie, Ont., producer of epoxy compounds are licensed from the *Epoxylite Corp.*, El Monte, Cal.

Advanced Materials Div., Taylor Fibre Co., Norristown, Pa., has been organized for research and development work in laminated plastics and vulcanized fibre. Taylor also has opened a glass-base laminated plastics warehouse in Chicago.

A 65,000 sq. ft. addition to *Ling-Altec Electronics Inc.*, Anaheim, Cal. has been announced. The Culver City



plant of the electronic test equipment manufacturer will be moved to the Anaheim location.

Panelyte Div., St. Regis Paper Co. plans expansions at the industrial laminating plant, Trenton, N. J., and the thermoplastics plants at Cambridge, Ohio; Dexter, Mich.; and Richmond, Ind.

Chemplast Inc., East Newark, N. J. has expanded its facilities for the machining of "Teflon" TFE-fluorocarbon resins.

Hamlin Inc., manufacturer of electrical switches and potentiometers

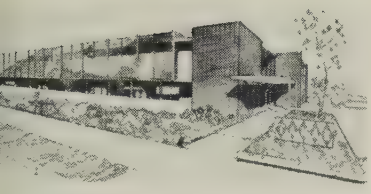
formerly of Skokie, Ill., has moved into its new plant in Lake Mills, Wis.

Accurate Specialties Co. Inc., Woodside, N. Y. has, through an exchange of common stock, acquired control of *Duramic Products Inc.*, New York City. The firms manufacture products for the semiconductor or ceramic fields.

Construction totaling 50,000 sq. ft. is now in progress at *Atlantic Research Corp.*, Alexandria, Va., research, development, and electronics manufacturing firm.

A new plant will be built in Marietta, Ohio at the existing plant site of *Union Carbide Plastics Co. Div. Union Carbide Corp.* When completed, an annual capacity of 2 million pounds of bisphenol-A is expected. It is used in epoxies and other plastics.

A 50,000 sq. ft. plant is under construction near Gardena, Cal., for *Tamar Electronics Inc.* and *Pres-T*



Corp. of America, Los Angeles
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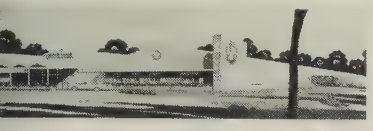
phis manufacturer of lighting



res, has started construction on a
000 sq. ft. second plant in Olive
ch, Miss.
ur times as much plant space has
provided *Reon Resistor Corp.* by
ecent move to a new plant in
kers, N. Y.
owell Electric Motors Co., Howell,
., has acquired *The Leland Elec-*
Co., Dayton, Ohio electrical motor
ufacturer from *American Ma-*
& Foundry Co. Leland will
ate as a wholly-owned subsidiary
owell.
I. du Pont de Nemours & Co.,
nington, Del., has formed an in-
ial sales district headquarters for
ilm Dept. in Cleveland. Lockhart
icks has been named manager.
nstruction has begun on a 50 per-
expansion for the production
city of bisphenol-A at *Monsanto*
nical Co., St. Louis. The mate-
is used in epoxies and polycar-
tes.
sulation Manufacturers Corp.,
ago, has become a full-line
ibutor of DuPont's "Mylar" pol-
r film. The firm's manufacturing
Inmanco, Chicago, has just com-
d a 5,000 sq. ft. plant addition
ndle coils, sheets, and fabricated
of Mylar and other plastic films.
io Semiconductors Inc., Colum-
Ohio, has acquired three new
ings covering approximately 23,-
sq. ft., supplementing the com-
's two present locations.
neral Mills Inc., Minneapolis,
acquired the business and assets
agnaflux Corp., Chicago manu-
rer of testing equipment. Magna-
will operate as a wholly-owned
diary of General Mills.

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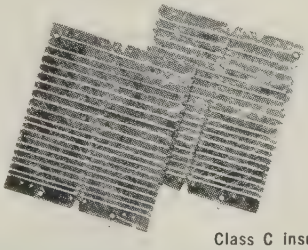

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Available in large sheets or stamped to specifications.

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For all types of starting and generating motors

Accurate to specified dimensions. Properties controlled to assure fullest efficiency of assembly and operation of commutators

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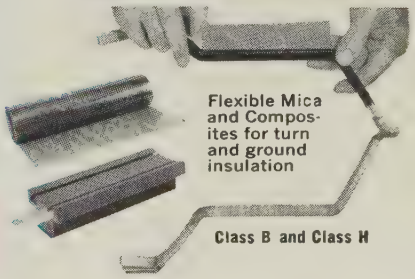
Round, square, rectangular
Class B and Class H

ARMATURE & FIELD COIL INSULATION



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Class B and Class H

Tell us your area of interest and we will send generous samples for testing — or, send drawings for quotation and learn how you can have better insulation at lower cost.

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of growing company. Experience in layout of multiple coil and skein winding. Capable of increasing production efficiency on precision windings. All class insulations. Excellent opportunity to expand with us. Salary commensurate with experience. Send resume to:

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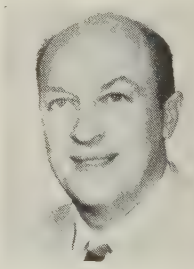
People in the News

Panelyte Div., St. Regis Paper Co., has appointed *Eli Hartz* general manager for thermoplastics manufactured in its three plants at Cambridge, Ohio; Dexter, Mich.; and Richmond, Ind. He was formerly manufacturing manager. *Alexander L. Leigh* was appointed general sales manager for thermoplastics and molded products, *E. E. Sanders*, manager of thermoplastics sales development, and *V. L. Kiernan*, sales manager for major appliance thermoplastic products.

Joseph C. Duke has been appointed to a newly created position of executive vice president for sales administration and public relations by Minnesota Mining and Manufacturing Co., St. Paul, Minn. *Dr. R. W. Fritts* has been promoted to manager, thermoelectric project, by 3M.

Two vice presidents have been elected by Penn-Plastics Corp., Glendale, Pa. They are: *Andrew A. Dukert*, vice president in charge of engineering, formerly chief engineer and assistant general manager; and *Arthur H. Newton*, vice president in charge of manufacturing.


A. H. Dukert


A. H. Newton

Technology Instrument Corp. of California, Los Angeles, has appointed *Ivan Dornbush* general manager.

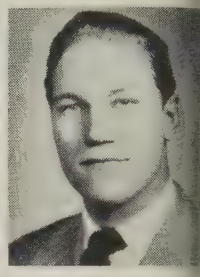

I. Dornbush


A. E. Aune

Omaton Div., Burndy Corp., Norwalk, Conn. manufacturers of electrical connectors, has named *Alan E. Aune* sales manager.

George B. Howell has been named vice president of manufacturing for all of Leece-Neville Co.'s divisions. The Cleveland firm manufactures motors and other electrical equipment.


G. B. Howell


J. L. Hagstrom

Formica Corp., Cincinnati plastics producer, has named *John L. Hagstrom* as sales manager, molded products. He was formerly district manager in Milwaukee.

Gulton Industries Inc., Metuchen, N. J. electronics firm has announced the following appointments: *David A. Lupfer*, general manager, Materials and Ceramics Div.; *Robert Day*, general manager, Gulton Instrumentation Div.; *Dr. Robert C. Shair*, director of research, Alkaline Battery Div. and *Harlan P. Tripp*, manager of the ceramics coating dept.

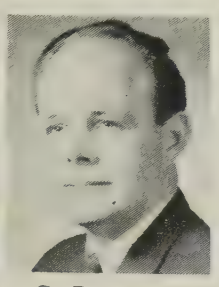
General Electric Co.'s Chemical Materials Dept., Pittsfield, Mass., has made the following appointments: *Richard J. Keates*, manager of manufacturing engineering of the phenolic products section; *Henry C. Nelson, Jr.*, general manager of the West Coast section at Anaheim, Cal.; *John B. Lidstone*, phenolic products market development specialist; *Harry A. Ackerman*, polycarbonates sales development specialist; and *Richard J. Lattizzori*, phenolic products project engineer.

Dr. John L. Zambrow has been appointed director of engineering of Sylvania-Corning Nuclear Corp., Bayside, L. I., N. Y.

Nytronics Inc., Berkeley Heights, N. J. electronics manufacturer, has appointed *Bernard M. Goldsmith* president.

merican Super-Temperature
es Inc., Winooski, Vt., has ap-
ted *James Kenny* vice president
harge of engineering. He had been
f engineer.

J. Kenny



G. Pottmeyer

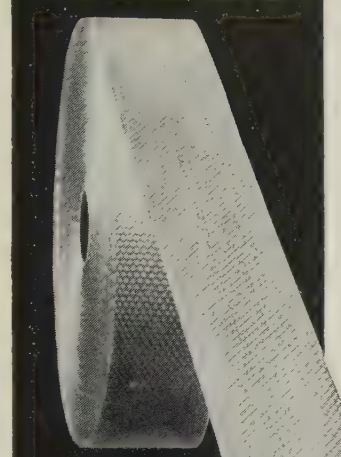
sulation Manufacturers Corp.,
ago, manufacturer and distrib-
of electrical insulations, has ap-
ted *Glenn Pottmeyer* branch office
ager of its Pittsburgh office.
ata Systems Engineering Div.,
o Corp. of America, Hicksville,
., N. Y. electronics firm, has ap-
ted *Fred Wolff* acting manager.
oel S. Siegel has been appointed
tant to the president by New
and Instrument Co., Waltham,
s. precision potentiometer manu-
irer.

. S. Siegel

R. G. Vance

well-Parker Electric Co., Cleve-
manufacturer of electric indus-
trucks, has named *Robert G.*
e chief development engineer.
Robert Stone has been named
production engineer by Potter
umfield Div., American Machine
undry Co., Princeton, Ind. elec-
l relays manufacturer.
Cleveland electronic equipment
ufacturer, Avtron Mfg. Inc., has
inted *Ruben Kazarian* chief en-
er.
ngineers *John M. Bandarra, Jr.*,
G. Grothues, Donald W. Koppel-
Marvin O. Sherfey, and *Stephen*
omsic have been assigned to the
er Equipment Div., Allis-Chal-
Mfg. Co., Milwaukee. *Thomas*
'ambach has been assigned to the

RUSCO



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ELECTRICAL GLASS TAPES
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Conductor Insulation — Similar
Applications in Electrical Apparatus

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EPOXY SOLVENTLESS VARNISH
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the new
RANDAC SYSTEM **E-09**

Better fill . . . deep penetration . . . improved adhesion . . . high thermal shock resistance . . . are just 4 of the insulation advantages your components get with MR's new System E-09. Dense coil windings need fewer impregnating cycles, because there's no solvent to bake out. Extra adhesive power and resistance to thermal shock make it ideal for subsequent epoxy dip encapsulations. Tests also prove the two-part E-09 system valuable for transparent resin castings.

RANDAC system E-09 features:

- *High wetting power*
- *High penetrating power*
- *Excellent film-forming properties*
- *Excellent adhesion*
- *Excellent toughness and moisture resistance*
- *Low electrical losses and high resistivity at 155°C.*

WRITE, WIRE, PHONE TODAY for complete E-09 System Specifications.

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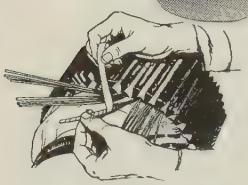
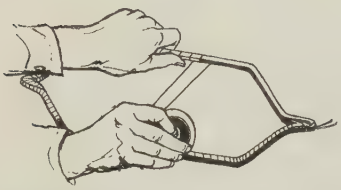
CLASS H SUPPORTED TAPES



FOR HIGH TEMPERATURE USE



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- ***Semi-Cured Tapes:*** A semi-cured silicone rubber coating on glass or other fabrics. Tape has no interliner and heat is required to bond multiple layers of tape. Tapes can be supplied coated on one side or two sides.
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Magnet Wire, Airframe Wire, Hook-up Wire
Coaxial Cables, Miniature & Jumbo Cables, Tapes
Teflon or Silicone Rubber Insulations

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nuclear power dept., and *Ronald K. Bukowski* has been appointed assistant engineer there. *William D. Olmsted* has been named application engineer in A-C's switchgear dept., *John L. Chisum, Jr.* and *Walker L. Hopkins* have been named to the General Products Div., and *James B. Cockoft* has been appointed application engineer in the control dept. The steam turbine dept. of A-C has appointed *E. J. Rosecky* as engineer-in-charge, and *R. D. Baird*, chief analyst. The York Works has appointed *Harry M. Rabe* as works manager of turbines.

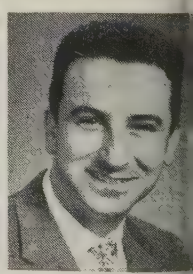
Consolidated Electrodynamics Corp., Pasadena, Cal., has appointed *Herbert I. Chambers* associate director of the DataTape Div.; *Fred L. Grant*, manager of the engineering dept.; *Edgar E. Hotchkin*, manager of the magnetic head section, and *Dr. John G. Frayne*, manager of development engineering, Datalab Div.

Parker V. Phillips has been named manager, field research section, Hussmann Refrigerator Co., St. Louis.

Mystik Adhesive Products Inc., Industrial Div., pressure sensitive tape and adhesives producer, has appointed *Harry Underwood* as sales representative for the state of Texas, with headquarters in San Antonio. *Vernon K. Jack* has been appointed representative in the northern Ohio and Pittsburgh area.

Synthane Corp., Oaks, Pa. manufacturer and fabricator of industrial laminated plastics, has named *Robert LeMay* and *Henry A. Fleer* to the Chicago district sales staff.

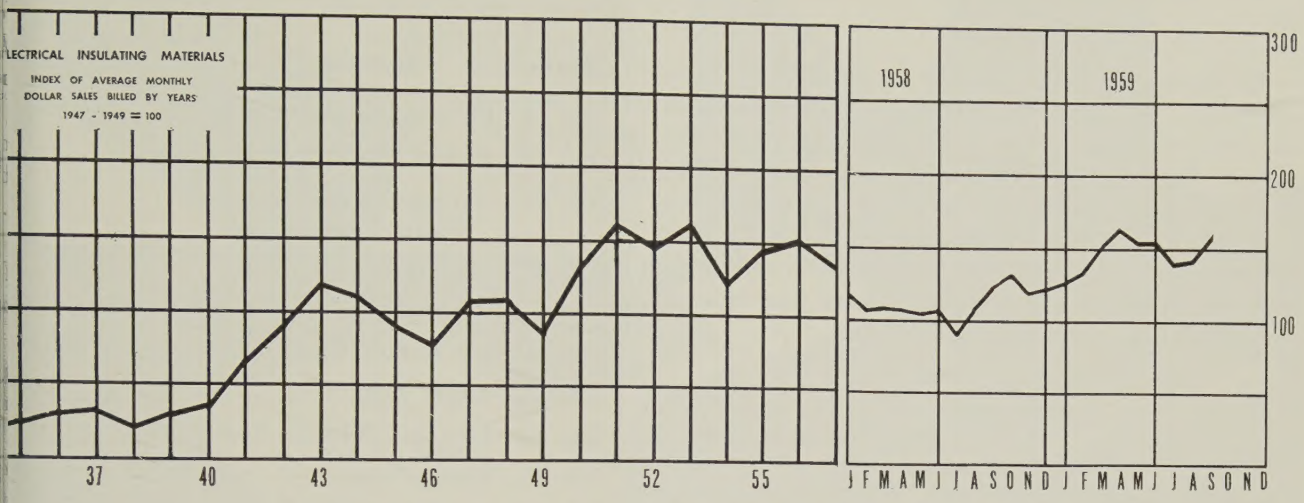
R. LeMay



H. A. Fleer

Sylvania Lighting Products Div., Sylvania Electric Products Inc., Salem, Mass., has appointed *William B. O'Keefe* operations manager, incandescent and photoflash lamp manufacturing. Sylvania's Semiconductor Div., Woburn, Mass., has appointed *S. George Lawson* to the newly created position of operations manager

NEMA Electrical Insulation Index



	Sept. '59	Aug. '59	Sept. '58
x series	160	145	124
'59 point change from other mos.		+15	+36
'59% change from other months		+10	+29

x is based on 1947-1949 average month, inclusive= 100

ished through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products

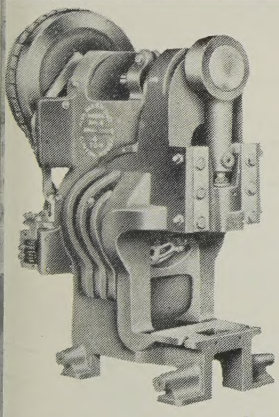
Manufactured Electrical Mica

Varnished Fabric and Paper

Vulcanized Fibre

Varnished Tubing and Saturated Sleeving (From May, 1952)

ALLEN Model BM-4—4 Ton Heavy Duty Punch Press



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Few of the many features

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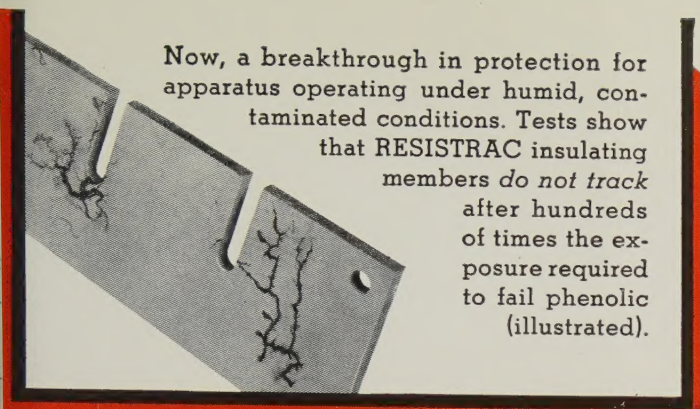

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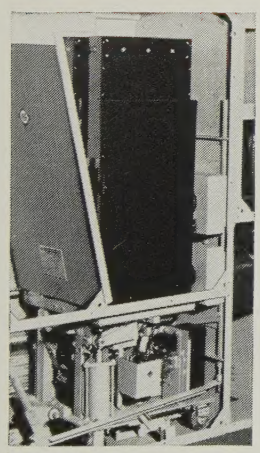

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